Retrofitting Nebraska 2015

Installation Standards for

Single Family and Manufactured Homes

created by

The Nebraska Weatherization Assistance Program

Nebraska Weatherization Assistance Program
Weatherization Installation Standards

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1 INSPECTIONS, ENERGY AUDITS, DEFERRALS AND CLIENT EDUCATION

Completing a thorough and accurate inspection and energy audit is essential for assessing how much energy a building uses, how the building uses the energy, what measures are cost effective for implementation in the building and how much energy/ costs can be saved with following implementation. Utilizing a systematic process of inspecting, documenting, evaluating and analyzing the building and its energy using systems helps ensure the accuracy of the *savings-to-investment ratio* (*SIR)* calculations for energy efficiency measures to be installed through the Nebraska Weatherization Assistance Program (NeWAP).

1.01 Inspections

1.0101 Initial On-Site Inspection

Completing an accurate on-site inspection for use in completing an Energy Audit includes, but is not limited to verification and documentation of:

- Inspecting the exterior of the building, noting:
  - the exterior sheathing material(s)
  - roof conditions, pitch, materials, and penetrations
  - building exposure, orientation and conditions
  - plumbing or electrical penetrations into the home/building
  - door and window locations, types, conditions, and sizes
- Inspecting the interior of the building and documenting:
  - wall condition, types, and thickness
  - existing insulation types, locations, and R-values

    2.0104.1 (a,b,c,d) Health and Safety – Safe Work Practices – Insulation –Vermiculite (SF) (MH)
  - sources and signs of moisture and/or *Vapor barriers*
  - existing electrical hazards

    2.0107.1 (a) Health and Safety – Safe Work Practices – Baseload –Baseload Worker Safety (SF)
  - existing lead based paint
  - the location and type of existing CO detectors
- Conducting Indoor Air Quality and CO Tests
- Conducting Combustion Safety and Efficiency Tests

  2.0203.1 (a,b) Combustion Air for Natural Draft Appliances (SF)
- Completing *Combustion Appliance Zone (CAZ*) Testing

  2.0105.1 (a,b,c) Health and Safety – Safe Work Practices – Heating and Cooling Equipment – Combustion Worker Safety (SF)
- Performing HVAC Distribution Tests
- Evaluating and documenting all existing Mechanical Systems, including but not limited to:
  - furnaces, boilers, heat pumps, air conditioners, water heaters
  - all system controls
  - all system working conditions
  - wiring or electrical concerns
  - signs of corrosion or rust
  - duct and/or flue conditions or concerns
  - signs of water leakage
- Evaluating and documenting existing Ventilation Systems

- existing ventilation equipment, controls and working condition
- Evaluating and documenting existing Appliances
  - appliance type, age, condition, hours/patterns of use
- Evaluating and documenting baseload equipment
  - equipment type, age, condition, hours/patterns of use
- Performing Blower Door Tests
- Verifying and evaluating the adequacy of Attic Ventilation
  - Use the following tables to calculate the net free area of the existing roof/attic venting:

Roof Vent	**Net Free Vent Area**
8" diameter	50 square inches
9" diameter	60 square inches
9.5" diameter	70 square inches
10" diameter	80 square inches
13.5" diameter	144 square inches
Turbine	239 square inches
Rectangular Gable Vent	**Net Free Vent Area**
8" x 12"	48 square inches
12" x 18"	108 square inches
14" x 24"	168 square inches
18" x 24"	216 square inches
24" x 30"	360 square inches
Soffit Vent	**Net Free Vent Area**
4" x 16"	32 square inches
8" x 16"	64 square inches
4" x 8"	16 square inches

Triangular Gable Vent	**Net Free Vent Area**
30" base	82 square inches
48" base	144 square inches
72" base	197 square inches

- Net free vent area for other size rectangular vents may be determined by using the following formula: **Net Free Inches = (Width x Height) divided by 2**
- Net free vent area for other size triangular vents may be determined using the following formula: **Net Free Inches = (Width x Height) divided by 4**

1.0102 **Pre-Implementation Inspection**

When you receive the weatherization file review the approved estimation form and other related documents:

- Understand what work has been called for and what materials will be needed.

- Note any mechanical work that was to be completed prior to the start of building shell weatherization activities.
- Know the order in which activities are to be completed.
- Clarify with the auditor anything about the job that is unclear or incomplete.
- Confirm the date/time of arrival at the client's house.
- Verify that all materials, supplies, tools, equipment are on the truck. Track inventory items as required.

At the job site greet the owner/tenant, identify yourself, state your purpose, and review the job schedule.

- Manage their expectations as needed.

Walk around the exterior of the home:

- Confirm the information in the audit.
- Note anything not recorded in the estimation form that could affect the completion of installation activities.
- Record any changes to the building exterior or problems that could interfere with installation activities.

Walk through the interior of the home:

- Confirm the information in the audit.
- Note anything not recorded in the Estimation forms that could affect the completion of installation activities.
- Record any changes to the building interior or problems that could interfere with installation activities.
- Contact your weatherization coordinator or supervisor for further instructions if:
  - The *Heating Plant* or other combustion appliance is currently malfunctioning.
  - Household members exhibit symptoms that could be from carbon monoxide poisoning. Open windows or evacuate the house if necessary.
  - There is a strong odor of heating gas or sewer gas. Open windows or evacuate the house if necessary.
  - Existing conditions have changed in ways that would make proposed work difficult or no longer cost-effective. Example: shingles/roof are in such bad shape that attic and/or slanted ceiling insulation could be damaged by water.

Complete initial diagnostics:

- Include blower door and pressure diagnostics tests.
- Record test results in the client file.

Review proposed work with the client:

- Explain what will be happening, and approximately how long it will take.

1.0103 *Quality Control Inspections*

As per U.S. Department of Energy Weatherization Program Notice 15-4 – Every Unit reported as a "completed unit" must receive a final *Quality Control Inspection* ensuring that all work meets the

minimum specifications **1.0101** outlined in the Standard Work Specification (SWS) in accordance with 10 CFR 440. *Quality Control Inspections* ensure that weatherization services have been provided in a quality manner and that the home is left in a safe condition.

All *Quality Control Inspections* will include, but not be limited to:

- A complete file review verifying:
  - Appropriate lead paint documentation
  - Completion of a mold and moisture assessment
  - Appropriate completion and documentation of combustion appliance testing
  - Appropriate completion of blower door and pressure diagnostics
- An on-site work assessment of completed weatherization work including, but not limited to:
  - *Building envelope* insulating and air sealing
  - Installation of venting and damming for *High Heat Sources* and insulation preservation
  - Heating, cooling and water *Heating System* repairs and/or replacement
  - Energy related window/door repairs
  - Baseload energy saving work
  - Health and safety related work
- Client Interview(s)
- Core Sampling ***must*** be completed on a minimum of 5% of all frame homes billed each month in which insulation is installed in an enclosed cavity ***must*** be tested by the sub-grantee for proper weight and density by taking a minimum of 3 core samples.
  - The core samples ***must*** be taken in random locations.
  - In sidewalls, 1 core sample ***must*** be taken within 3 feet of the top of the wall.
  - The results of the core samples ***must*** be recorded on the inspection form and retained in the client's files.
- Verify that all completed work and installed materials meet minimum state and local codes.
- Verify that all completed work and installed materials are installed according to manufacturer's instructions, unless otherwise specified by the State Plan.

1.02 Energy Audit

Completing an accurate Energy Audit requires appropriate analysis of the on-site inspection information based on the following NeWAP requirements:

- Using the appropriate, most current authorized version, of the NeWAP and DOE approved auditing program to determine what Energy Efficiency Measures ***must*** be implemented. The auditing Tools currently mandated for use in the NeWAP are:
  - The National Energy Audit Tool (NEAT), for single family homes
  - The Mobile Home Energy Audit (MHEA), for *Manufactured Homes* or
  - The Targeted Retrofit Energy Analysis Tool (TREAT) *for Multi-family Buildings*
- Performing a site-specific Energy Audit on all frame, masonry, modular, and *Manufactured Homes* and verifying that:
  - Homes with a cumulative *SIR* of less than 1.0 *must not* be weatherized.
  - Individual audit measures with an *SIR* of less than 1.0 *must not* be implemented.
- Retaining a copy of the audit in the clients' file.
- Using local weather data when running the site-specific audits.
- Using average state fuel costs when running site-specific audits.

- The Nebraska Energy Office will provide updated fuel costs to sub-grantees on an annual basis.
- Using local material and labor costs when running site-specific audits.
  - If sub- grantees cannot use actual material and labor costs, use estimated material and labor costs updated a minimum of every 12 months.

Verifying that the audit measures recommended for implementation by NEAT, MHEA or TREAT audit have individual *SIRs* of 1.0 or greater. Audit measures with an *SIR* of less than 1.0 ***must not*** be implemented. Installing a measure with a lower *SIR* without installing others with greater *SIR*s is not allowed.

Verifying and documenting that, in addition to the measures that are required to be implemented based on Energy Audit, all additional weatherization requirements included in the Installation Standards are implemented. Any exceptions associated with not completing recommended or required measures must be appropriately documented in the client's file.

Verifying that all Energy Audits are completed using the Key Parameters and Default Parameters established by the Nebraska Energy Office with no modifications unless authorized.

- NEAT Candidate Measures mandated for use by all sub-grantees: in single family homes
  - R-11, R-19, R-30, R-38 and R-49 ceiling/attic insulation
  - Fill ceiling cavity
  - Sill box insulation
  - Foundation wall insulation
  - R-11, R-19 R-30 and R-38 floor insulation
  - Wall and *Kneewall* insulation
  - Window sealing
  - Window replacement
  - Storm windows
  - Low E windows
  - Furnace tune up
  - High efficiency boiler
  - High efficiency furnace
  - AC tune up
  - AC replace
  - Install/replace heat pump
  - Water heater tank and pipe insulation
  - Water heater replacement
  - Lighting retrofits
  - Low flow shower heads

- MHEA Candidate Measures mandated for use by all subgrantees: in *Manufactured Homes*
  - General air sealing
  - Add skirting
  - Wall fiberglass batt, loose fill cellulose and fiberglass
  - Wall fiberglass batt, loose fill cellulose and fiberglass in Additions
  - Floor loose fill fiberglass
  - Floor loose fill cellulose and fiberglass in Additions

- Roof loose fill fiberglass
- Roof loose fill cellulose and fiberglass in Additions
- Add skirting on Additions
- Replace marked doors (mandatory)
- Replace wooden doors
- Replace wooden doors in Additions
- Storm doors
- Storm doors in Additions
- Window sealing
- Window sealing in Additions
- Replace single paned windows
- Replace single paned windows in Additions
- Glass or Plastic storm windows
- Glass or Plastic storm windows in Additions
- Tune *Heating System*
- Tune *cooling system*
- Replace dx (direct expansion) cooling equipment
- Lighting retrofits
- Water heater tank and pipe insulation
- Low flow shower heads
- Water heater replacement
- Replace *Heating System*

Note: Blown fiberglass insulation is non-corrosive to metal skinned Manufactured Homes and can achieve good R-values and convection resistance at lower densities and weights that won't cause damage to the interior sheeting or underbelly of the home. Installations that include cellulose insulation may be completed only after warrantee information is provided by the installer ensuring no future damage to either the ceiling or underbelly of the home as a result of the use of cellulose insulation.

Audits determine what energy efficiency measures must be implemented. The Installation Standards determine how audit measures are to be implemented.

Verifying that Ineligible Materials/Measures, as listed below, are not recommended for implementation or installed:

- Shade screens, rigid awnings, louver systems or window films
- Vestibules
- Automatic gas ignition systems
- Microcomputer burner controls
- Desuperheater/water heaters
- Energy recovery equipment
- Whole-house fans
- Liquefied petroleum gas storage
- Electric freeze-prevention tape for pipes
- Stack dampers on gas or oil-fueled water heaters
- Gas conversion power burners for gas or oil-fueled *Heating Systems*
- Reduce input of burner or derate gas-fueled equipment
- Vent dampers for gas or oil-fueled *Heating Systems*
- Reduce excess combustion air by reducing vent connector size of gas- fueled appliances
- Industrial-grade white paint used as a heat-reflective measure on awnings, window louvers, doors

and exposed, exterior ductwork

Verifying that, pursuant to DOE Guidance:

- ALL *multi-family* projects that include 5-24 units per building having a centralized heating/cooling system, or projects that have 25+ units per building have been submitted for DOE evaluation and approval by the DOE Project Officer prior to any weatherization work being done.
- Projects with 2-4 units per building are treated as *single-family* units, not requiring DOE Project Officer approval.
- *Multi-family* projects with 5-24 units per building that are individually heated/cooled (also known as *distributed* heating/cooling) are evaluated using the Grantee's *single-family* audit tool (if it has been approved by DOE for such use) and also do not require approval from the DOE Project Officer.
- The Nebraska Energy Office has reviewed the submission from the Subgrantee and made a compliance determination regarding DOE Guidance as well as whether the proposed measure cost test are reasonable (ex. no manipulation of the costs have occurred to make certain measures allowable). Following NEO approval, the project package was submitted (by NEO) to the DOE Project Officer requesting DOE approval to proceed with the project.

All *multi-family* projects must be submitted to the Nebraska Energy Office as per the U.S. Department of Energy's *Multi-Family* Review Protocol revised on November 1, 2011. Common areas in *Multi-family Buildings* may be weatherized like the closest living unit.

Verifying and documenting all *Incidental Repair* Costs necessary for the installation or preservation of a weatherization measure. Keeping in mind that:

- The cost of the incidental repairs, specific to weatherization measures, should be included in the cumulative cost indicated by the Energy Audit and *SIR* calculation for the home.
- Repairs that can be classified as incidental to specific weatherization measures (i.e. attic, walls and floor insulation) should be charged to those measures if the inclusion does not make the implementation of the measure ineligible by reducing the individual *SIR* below 1.0.
- *Incidental repair cos*ts on a home must not exceed $500.

Verifying that the home complies with ASHRAE Standard 62.2 and DOE Guidance requirements

- Complete pre- and post-weatherization ASHRAE 62.2 evaluations to ensure that the home meets the *Standard for Acceptable Indoor Air Quality* and include both evaluations in the client file.
- Install *Continuous Ventilation* as required.

1.03 Deferrals

The decision to defer work in a dwelling is difficult but necessary in some cases. Sub-grantees are expected to pursue reasonable options on behalf of clients and to use good judgment in dealing with difficult situations. Deferral conditions may be found in the Health and Safety Section 2 of this Installation Standard. Should any dwelling be determined to be a deferral:

- The client will be advised of the problem, and, if possible, refer them to other service organizations that may be able to assist in solving the problem.
- Inform the client in writing as to why the dwelling cannot be weatherized and if there are conditions that the client must correct before weatherization services are provided those conditions must also be stated in writing.
- Indicate clearly in the client file why the dwelling was given "deferral" status on the NeWAP Weatherization Deferral Notice.

- Provide and utilize a system for a timely and fair administrative hearing of complaints received from clients denied services. An unreasonable delay in acting on an application for assistance will constitute grounds for a hearing.
- Provide the applicant, at the time of application, written information that outlines the applicant's rights and the method for filing a complaint. All Sub-grantees are required to adhere to their agency's grievance polices. If the grievance cannot be resolved through the Sub-grantee's process, the applicant will file a complaint with the Energy Office.

A "walk-away/deferral" is not a completion. Reimbursement for "walk-away/ deferral" must be obtained through the normal monthly billing process. Indicate on the BCJO (Building Check Job Order) that the dwelling is a "walk- away/deferral" and the client was advised in writing of the conditions determining this status.

Defer all units undergoing remodeling or which have untreated remodeled areas that directly affect the weatherization process.

- Keep the client's application as part of the sub-grantee's records until recertification is necessary. Weatherization of the unit may proceed if remodeling is completed to the standards of a completed dwelling unit and the client continues to qualify for the program at the time of completion.

1.04 Client Education

The NeWAP provides sub-grantees with an opportunity to educate clients and provide them with some simple, easy and inexpensive energy saving tips to help them save additional energy while improving comfort.

1.0401 Heating and Cooling Saving Suggestions:

- During the heating season, keep the draperies and shades on your south-facing windows open during the day and close them at night to reduce the chill from cold windows.
- During the cooling season, keep the window coverings closed during the day to prevent overheating.
- Check/change/clean furnace filters monthly or as needed.
- Don't obstruct registers with furniture and if they operable use them accordingly.
- Clean dirty grilles.
- Use circulating fans indoors to improve comfort.
- Close interior doors to limit heating and cooling areas of the home that are not used continually.
- Securely close prime and storm windows regularly during the heating and cooling seasons.
- Complete annual furnace and air conditioner inspections and maintenance.
- Turn off kitchen, bath, and other exhaust fans within 20 minutes after you are done cooking or bathing.

1.0402 Hot Water and Laundry Saving Suggestions:

- Wash clothes in cold water whenever possible.
- Wash and dry full loads of clothes.
- Clean the dryer lint filter after each load and keep the outside vent clear and clean.
- Repair leaky faucets promptly.
- Sink aerators

1.0403 Other Energy Saving Opportunities:

- Turn off lights, appliances, electronics, TVs, and computers when not in use.

- Cook in a microwave oven to save energy compared to cooking with a conventional range or oven.
- Unplug small electrical charging transformers when not needed.

1.0404 Health and Safety Educational Material

The NeWAP requires that all clients be provided with educational material specifically associated with Health and Safety issues with documentation of receipt included in the client file.

2 HEALTH AND SAFETY

Health and safety measures ***must*** be performed in conjunction with cost-effective weatherization. Allowable health and safety activities are those that eliminate hazards that are affected or caused by the installation of weatherization materials.

Major hazards and potentially life-threatening conditions ***must*** be corrected before weatherization installers can work in the dwelling unless the installers are making the corrections.

When a weatherization agency finds serious safety problems in a customer's home, they ***must*** inform the customer in writing about the hazards.

When Not to Weatherize a Dwelling

There are some conditions and situations under which a sub-grantee ***must*** not or ***may choose*** not to weatherize an otherwise eligible dwelling unit. Information for making this determination may become evident during either the eligibility process or during the initial inspection. If the sub-grantee makes a determination that there are circumstances that prevent the weatherization process from proceeding, they ***must***:

- Advise the client of the problem, and, if possible, refer the client to other service organizations that may be able to assist in solving the problem.
- Inform the client in writing as to why the dwelling cannot be weatherized. A copy of the letter must be in the client file.
- Provide documentation of the conditions that the client must correct before weatherization services are provided.
- Clearly indicate in the client file why the dwelling was given "deferral" status.
- Have available a system for a timely and fair administrative hearing of complaints .received from clients denied services. An unreasonable delay in acting on an application for assistance will constitute grounds for a hearing.
- Provide the client with a completed copy of the Nebraska WAP Weatherization Deferral Notice (Form Wx4).

At the time of application, the applicant is given a written notice outlining the applicant's rights and the method to file a complaint. All Sub-grantees are required to adhere to their agency's grievance polices. If the grievance cannot be resolved through the Sub-grantee's process, the applicant will file a complaint with the Nebraska Energy Office.

A sub-grantee ***must*** not weatherize if:

- The unit was weatherized with DOE funds after September 30, 1994. For current DOE guidelines and further explanation see DOE regulations in CFR440.
- The dwelling is vacant. (Exception: multi-family units using DOE funds and the 50% or 66% rule).
- Demolition of the dwelling is scheduled in the next 12 months.
- The dwelling is for sale.
- The dwelling has serious structural problems that make weatherization impossible or impractical.
- The *Heating System* has not passed a safety and operational audit and inspection.
- The building structure is in such state of disrepair that failure is imminent and the conditions cannot be resolved cost-effectively.
- The house has sewage or other sanitary problems that would further endanger the client and weatherization installers if weatherization work were performed.
- The house has been condemned by local or state building or enforcement officials.
- Moisture and/or mold problems are so severe they cannot be resolved with minor repairs.
- The occupant or client is abusive or threatening to the crew, subcontractors, auditors, inspectors or others who must work on or visit the house.

A sub-grantee **may choose** not to weatherize a dwelling unit if:

- The building mechanical systems, including electrical and plumbing, are in such state of disrepair that failure is imminent and the conditions cannot be resolved cost-effectively.
- The extent and condition of lead-based paint in or on the house would potentially create further health and safety hazards.
- In the judgment of the energy auditor, any condition exists which may endanger the health and/or safety of the occupant, work crew or subcontractor, the work should not proceed until the condition is corrected.
- There are unusual situations which in the judgment of the auditor/subgrantee must be corrected before providing weatherization services.

Client Health and Safety

There are a number of important health and safety issues related to weatherization work that can impact weatherization employees as well as clients. When any of these issues are detected, the client ***must*** be informed of the issue and, if possible, addressing these problems should be a top priority.

- All NeWAP sub-grantees ***must*** complete appropriate safety testing on all combustion appliances. Documentation of the testing results **must** be included in all client files.
- All moisture problems ***must*** be documented and discussed with the client. Sub-grantees must ensure that no weatherization work will contribute to making moisture problems worse. Mold and Moisture information must be documented on the Mold Assessment and Release Form (Form Wx5) and included in the client file.

HEALTH AND SAFETY ASSESSMENT

Energy Auditors and crews/subcontractors are required to take all reasonable precautions against performing work on homes that will subject workers or clients to health and safety risks. The initial home inspection ***must*** include a health and safety assessment of the dwelling. The assessment ***must*** include interviewing the client regarding known health concerns, inspecting the dwelling for present or potential moisture concerns, indoor air quality concerns and other environmental concerns or hazards

that may or may not be covered by the NeWAP. In addition, clients will receive the following publications or documents when applicable:

- Health & Safety Assessment Consent (Form Wx6)
- Health and Safety Home Screening Questionnaire (Form Wx7)
- Renovate Right (occupants of all buildings built pre-1978)
- Lead Hazard Pre-Renovation Form (Form Wx3)
- Nebraska Radon Information Fact Sheet
- A Brief Guide to Mold, Moisture and your Home
- Nebraska Mold Assessment and Release Form (Form Wx5)
- Consumer Product Safety Asbestos Fact Sheet
- Nebraska WAP Even More Dollar and Energy Savings Brochure
- Weatherization Deferral Notice (Form Wx4)
- Consent to Perform Work (Form Wx6)
- Client Education Confirmation of Receipt (Form Wx2)

Sub-grantee personnel will interview and assist clients in completing a Health and Safety Home Screening Questionnaire (Form Wx7) as part of the application process. The survey will be included in the client file for future reference. The Energy Auditor will then review the Questionnaire with the client at the time of the initial assessment. The information collected during this process will be used in determining the best course of action for weatherization of the home. When a client's health is fragile and/or the weatherization activities would constitute a health or safety hazard, the occupants at risk will be required to leave the home during the activities and requested to return at least 1 hour (or a reasonable time as determined by the installers) after installers are scheduled to leave to allow for clean-up and appropriate ventilation of the home. If it is determined through the Health and Safety Home Screening Questionnaire that someone in the home is sensitive to a product that is intended to be used during the weatherization process, the sensitivity ***must*** be documented in the file and, if possible, an alternative product may be used. If no successful alternative is found, the weatherization of the home may proceed without completion the measure with no impact on weatherization measures with lower *SIR*s, ***with prior Nebraska Energy Office approval***. Weatherization funds ***cannot*** be used to relocate clients or reimburse them for such costs incurred as a result of the requirement to leave during the day. If the client is unable to leave the home and the intended work may exacerbate an occupant's health condition, the home may need to be deferred.

Sub-grantees ***must*** take all reasonable precautions against performing work on homes that would subject clients to health and safety risks.

2.01 Safe Work Practices

Worker Health and Safety

Grantee weatherization staff is vitally important and staff ***must not*** be required to work in unsafe and/or excessively unsanitary conditions. Costs related to grantee health and safety training ***must*** be charged to Training & Technical Assistance.

- Sub-grantee crews and contractors must comply with Occupational Safety and Health Administration (OSHA) standards and Material Safety Data Sheets (MSDS) and take precautions to ensure the health and safety of themselves and other workers, including the use of personal protection equipment.
- OSHA 10 hour training is required for all weatherization workers.

- OSHA 30 hour training is required for all crew leaders.
- Costs incurred by sub-grantees to comply with OSHA requirements may be charged to the Health and Safety budget category.
- OSHA standards including, but not limited to:
  - respirator protection,
  - techniques for safely lifting heavy objects,
  - electrical equipment safety,
  - ladder safety, and
  - general worker protection.
- Sub-grantees ***must*** consult OSHA standards for further details.
- MSDS documentation for all materials installed through the Nebraska Weatherization Program ***must*** be maintained on site during the weatherization of the home and on file by each program sub-grantee.

  2.0110.1 (a,b,c) Health & Safety – Safe Work Practices – Material Selection, Labeling, and Material Safety Data Sheets (MSDSs) (SF) (MH)
- Personal protective equipment ***must*** be worn when appropriate.

  2.0100.1 (b,c,f) Health & Safety –Safe Work Practices - Global Worker Safety (SF)

  2.0100.2 (b,c,d) Health & Safety –Safe Work Practices - Global Worker Safety (MH)

  2.0105.2 (d) Health & Safety –Safe Work Practices – Heating and Cooling Equipment – Protective Clothing (SF)

  2.0105.4 (d) Health & Safety –Safe Work Practices – Heating and Cooling Equipment – Protective Clothing (MH)
- The following Worker Health and Safety concerns ***must*** be addresses, implemented and enforced within the NeWAP:
  - Global Worker Safety

    2.0101.1 (a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p) Health & Safety – Safe Work Practices – Global Worker Safety (SF)

    2.0100.2 (a,b,c,d,e,f,g,h,i,j,k,l,m) Health & Safety – Safe Work Practices – Global Worker Safety (MH)

    2.0103.1 (a) Health & Safety – Air Sealing – Air Sealing Worker Safety (SF) (MH)

    2.0106.1 (a) Health & Safety – Ventilation Equipment – Ventilation Worker Safety (SF) (MH)
  - Tool Safety

    2.0100.1 (h,k,l) Health & Safety –Safe Work Practices - Global Worker Safety (SF)
    2.0100.2 (f,i,j) Health & Safety –Safe Work Practices - Global Worker Safety (MH)
  - Electrical Safety

    2.0100.1 (d) Health & Safety –Safe Work Practices - Global Worker Safety – Electrical Safety (SF)
  - Ergonomic and Repetitive Stress Injuries

    2.0100.1 (j) Health & Safety – Global Worker Safety – Safe Work Practices – Ergonomic Safety (SF)

    2.0100.2 (h) Health & Safety – Global Worker Safety – Safe Work Practices – Ergonomic Safety (MH)
  - First aid supplies ***must*** be available in the office and at the job site.

Potential Hazard Considerations

Weatherization services ***must*** be provided in a manner that minimizes other potential risks to workers and clients. Awareness of potential hazards is essential in providing quality weatherization services. A list of common weatherization work situations that may present hazardous situations are addressed below:

2.010 Safe Work Practices

2.010 Global Worker Safety

2.0100.1 (a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p) Health & Safety – Safe Work Practices – Global Worker Safety (SF)

2.0100.2 (a,b,c,d,e,f,g,h,i,j,k,l,m) Health & Safety – Safe Work Practices – Global Worker Safety (MH)

2.0103 Air Sealing

2.0103.1 (a) Health & Safety – Air Sealing – Air Sealing Worker Safety (SF) (MH)

2.0104 Insulation

2.0104.1 (a,c) Health & Safety – Safe Work Practices— Insulation— Insulation Worker Safety (SF) (MH)

2.0105 Heating and Cooling Equipment

2.0105.1 (a,b,c) Health and Safety – Safe Work Practices– Heating & Cooling Equipment – Combustion Worker Safety (SF)

2.0105.2 (a,b,c,d) Health & Safety –Safe Work Practices – Heating and Cooling Equipment – Protective Clothing (SF)

2.0105.4 (d) Health & Safety –Safe Work Practices – Heating and Cooling Equipment – Protective Clothing (MH)

2.0201.1 (a,b,c,d,e,f,g) Health and Safety – Combustion Safety – Combustion Safety Testing-General - *Combustion Appliance Zone* (CAZ) Testing (SF)

2.0201.3 (a,b,c,d,e,f,g,h) Health and Safety – Combustion Safety – Combustion Safety Testing-General - *Combustion Appliance Zone* (CAZ) Testing (MH)

2.0203.1 (a,b) Health and Safety – Combustion Safety – Vented Gas Appliances - Combustion Air for Natural Draft Appliances (SF)

2.0203.4 (a,b,c,d,e) Health and Safety – Combustion Safety – Vented Gas Appliances - Combustion Air for Natural Draft Appliances (MH)

2.0203.5 (a,b,c,d,e,f) Health and Safety – Combustion Safety – Vented Gas Appliances - Combustion Flue Gas—*Orphaned* Water Heaters (MH)

2.0203.6 (a,b,c,d,e) Health and Safety – Combustion Safety – Vented Gas Appliances - Draft Regulation—Category I Appliance (MH)

2.0204.1 (a,b,c,d) Health and Safety – Combustion Safety – Isolation Isolating Combustion Water Heater Closet (MH)

2.0299.1 (a,b,c,d,e,f,g,h,I) Health and Safety – Combustion Safety – Combustion Appliance Depressurization Limits Table (MH)

2.0107 Baseload

2.0107.1 (a) Health & Safety –Safe Work Practices - Baseload – Baseload Worker Safety (SF)

2.0602.1 (a,b) Health and Safety – Electrical – Electrical Hazard - Static Electric Shock (MH)

2.0602.2 (a,b,c,d) Health and Safety – Electrical – Electrical Hazard - House Current Electric Hazard (MH)

2.0110 Material Safety

2.0100.1 (o) Health & Safety – Global Worker Safety – Safe Work Practices – Asbestos-Containing Materials (SF)

2.0104.1 (b) Health & Safety – Safe Work Practices – Insulation Worker Safety (SF) (MH)

2.0105.2 (c) Health & Safety –Safe Work Practices – Heating and Cooling Equipment – Asbestos (SF)

2.0105.4 (c) Health & Safety –Safe Work Practices – Heating and Cooling Equipment – Asbestos (MH)

2.0110.1 (a,b,c) Health & Safety – Safe Work Practices – Material Selection, Labeling, and Material Safety Data Sheets (MSDSs) (SF) (MH)

2.0111 *Basements* and *Crawl Spaces*

2.0111.1 (a) Health and Safety – Safe Work Practices – *Basements* and *Crawl Spaces* - *Basements* and *Crawl Spaces* Worker Safety (SF)

2.0111.2 (a,b,c,d,e,f,g) Health and Safety – Safe Work Practices – *Basements* and *Crawl Spaces* - *Crawl Spaces*—Pre-Work Qualifications (SF)

2.0111.3 (a,b) Health and Safety – Safe Work Practices – *Basements* and *Crawl Spaces* - *Crawl Spaces*—Debris Removal (SF)

2.0111.4 (c) Health and Safety – Safe Work Practices – *Basements* and *Crawl Spaces* - Negative Pressure Contamination Control (SF)

2.0111.5 (a,b) Health and Safety – Safe Work Practices – *Basements* and *Crawl Spaces* - Prework Qualifications (Home Installation) (MH)

2.02 Combustion Safety Testing

NeWAP Sub-Grantees *Certified Weatherization Staff* or *Qualified Heating Technician must* complete inspections, testing and assessments on all combustion appliances within a home to ensure all equipment is operating safely.

2.0201 Combustion Safety Testing and Verification - General

Leak Test Gas Appliances and Piping

Conduct a fuel leakage test of the appliance piping and control system downstream of the meter to each appliance. Natural gas and propane piping systems may leak at their joints and valves. An electronic combustible gas detector (gas sniffer) will find all significant gas leaks if used carefully. Remember that natural gas rises from a leak and propane falls, so position the sensor accordingly.

- Sniff all valves and joints with the gas sniffer.

  2.0105.1 (a,b,c) Health and Safety – Safe Work Practices– Heating & Cooling Equipment – Combustion Worker Safety (SF)

- Accurately locate leaks using a non-corrosive bubbling liquid, designed for finding gas leaks.
- If gas leak is detected at the initial inspection, have occupant notify the fuel supplier or a *Qualified Heating Technician*. All gas leaks should be repaired prior to implementation of weatherization services.

  2.0105.1 (a,b,c) Health and Safety – Safe Work Practices– Heating & Cooling Equipment – Combustion Worker Safety (SF)

Verify the BTU Input on Natural Gas Appliances by Clocking (timing) the Gas Meter

To verify whether the gas being consumed matches the input of the appliance or to measure the input of a specific appliance:

- Turn off all gas combustion appliances such as water heaters, dryers, cook stoves, and space heaters that are connected to the meter you are timing, except for the appliance you wish to test.
- Fire the unit being tested, and watch the dials of the gas meter.
- Monitor the dials on the gas meter, timing how long it takes to burn a cubic foot of gas.
- Use the length of time it took to burn a cubic foot of gas (in seconds) in the following formula to calculate BTUs/hour: (3,600 x 1,000)/number of seconds

  In this formula 3,600 represents the number of seconds in an hour, and 1,000 is the number of Btu in one cubic foot of natural gas.
- Compare the BTUs/hour value you calculate at the meter with the input BTUs/hour labeled on the appliance.
- If the measured input is higher or lower than input on the name plate by more than 10%, the gas pressure can be adjusted by a *Qualified Heating Technician.*

- If the measured input is still out of range, the tech should recommend the system be inspected by the gas supplier.

Complete initial Inspection of the *Heating System*

- Visually inspect the venting system for proper size and horizontal pitch and determine that there is not blockage, vent size reduction or restriction, leakage, corrosion or other deficiencies that could cause an unsafe condition.
- Inspect burners and crossovers for blockage and corrosion.
- Determine that the pilot is burning properly, that main burner ignition is satisfactory and main burner is burning properly.
- Test the pilot safety device to determine that it is operating properly.
- If the appliance is equipped with a high and low flame control or flame modulator, check for proper main burner operation at low flame.
- Test for spillage at the draft hood relief opening.
- On furnaces and console heaters, check the fan control for proper operation.

  5.3003.9 (a,b,c,d,e,f,g,h,l,j,k,m,n) Heating & Cooling – Forced Air – System Assessment & Maintenance – Heating and Cooling Controls (SF)
- On boilers, inspect for evidence of water or combustion product leaks.
- On boilers, determine that the water pumps and automatic controls are in operating condition.
- If accessible, inspect the central air conditioner coils.
- Check the fan and belt condition.
- Inspect for exposed wiring.

  5.3003.-4 (a,b,c,d,e,f.g.h) Heating & Cooling – Forced Air – System Assessment & Maintenance – Evaluating Electrical Service (SF)
- Inspect the furnace heat exchanger.
  - Look for rust at exhaust ports and vent connector.
  - Look for flame impingement on the heat exchanger during firing.
  - Observe flame movement, change in chimney draft, or change in CO reading as blower is turned on and off.
  - Look for flame-damaged areas near the burner flame.
  - Measure the flue-gas oxygen concentration before the blower starts and just after it has started. There should be no more than a 1% change in the oxygen concentration.
  - Examine the heat exchanger, shining a bright light on one side and looking for light traces on the other using a mirror to peer into tight locations.
- Test and confirm the furnace efficiency operating standards.
  - Check heat rise after 5 minutes of operation. Refer to manufacturer's nameplate for acceptable heat rise (supply temperature minus return temperature).
  - The fan-off temperature should be between 90° and 95° F, or as per manufacturer's recommendations, with the lower end of the scale being preferable for maximum efficiency.
  - The fan-on temperature should be less than 120° F, or as per manufacturer's recommendations.
  - The high-limit controller should shut the burner off before the furnace temperature reaches 250°F.

Verify, Assess and Document Adequate Combustion Air Supply for All Combustion Zones

Combustion appliances required oxygen or combustion air to operate and some appliances draw combustion air from inside the home or *building envelope*. Completing an assessment on each

combustion appliance in a home ensures that a combustion air problem does not interfere with combustion, create Carbon Monoxide or contribute to spillage or back-drafting.

Combustion appliance zones are classified as either un-confined spaces or confined spaces.

- Un-confined spaces are open or connected to enough building volume to provide adequate combustion air.
- Confined spaces are *combustion appliance zones* with a closed door and sheeted walls and ceiling that create an air barrier between the appliance and other indoor spaces. A confined space is defined as a room containing less than 50 cubic feet of volume for every 1000 Btu per hour of appliance input.

2.0203.1 (a,b) Health and Safety – Combustion Safety – Vented Gas Appliances - Combustion Air for Natural Draft Appliances (SF)

NeWAP sub-grantees must verify and document in each client file that each *Combustion Appliance Zone* in a weatherized home has adequate combustion air supply.

When additional combustion air is required the following options shall:

- Provide combustion air from adjacent indoor spaces by installing a combustion air vent or grille or *Under-cutting* interior doors.
  - *The following is an example of sizing grilles to supply combustion air to a confined space from an adjacent indoor area:*
    1. *The furnace has an input rating of 100,000 Btu/hour.*
    2. *The water heater has an input rating of 40,000 Btu/hour.*
    3. *Therefore, there should be 280 in^2 of net free area of vent between the mechanical room and other rooms in the home. ([100,000 + 40,000] ÷ 1,000 = 140 x 2 in^2 = 280 in^2).*
- provide outdoor combustion air into the *combustion appliance zone* (CAZ), or
- analyze the cost effectiveness of installing direct-vent appliances that utilize outdoor combustion air.

The costs associated with installing the make-up fresh air must be charged to Health and Safety.

***Combustion Appliance Zone* (CAZ) Testing**

NeWAP Sub-Grantees *must* complete CAZ testing on all areas within a home that contain one or more *atmospherically vented combustion appliances*. CAZ testing *must* be completed on all weatherized homes, at the time of the initial and *Quality Control Inspections*, with all testing results documented in the client file using CAZ Depressurization Test Form (Wx9).

CAZ testing must include, but not be limited to:

- Carbon monoxide Testing
- Measuring Draft and House Pressures in Worst Case

2.0201.1 (a,b,c,d,e,f,g) Health and Safety – Combustion Safety – Combustion Safety Testing-General - *Combustion Appliance Zone* (CAZ) Testing (SF)

2.0201.3 (a,b,c,d,e,f,g,h) Health and Safety – Combustion Safety – Combustion Safety Testing-General - *Combustion Appliance Zone* (CAZ) Testing (MH)

Investigate Improving Inadequate Draft

If measured draft is below minimum draft pressures, investigate the reason for the weak draft. Open a window or door to observe whether the addition of combustion air will improve draft.

- If this added air strengthens draft, the problem usually is depressurization or lack of combustion air. Options to consider:
  - Return duct leaks.
  - Improper balancing between the supply and return.
  - Large whole house exhaust fans.
  - Attic fans.
  - Lack of appropriate make-up air.
- If opening a window has no effect, inspect the chimney. The chimney could be blocked, excessively leaky or a chimney liner is needed. Options to consider:
  - Improper sizing of the vent connector and/or chimney.
  - A vent connector or chimney liner that is either too large or too small.
  - Wind causing erratic draft.
  - The masonry chimney is deteriorated.

Combustion Monoxide Testing

Ambient CO levels should be monitored in the combustion zone during draft testing. If ambient CO levels in the combustion zone exceed 35 parts per million (ppm), draft tests should cease for the technician's safety. The combustion zone should be ventilated before draft-testing and diagnosis of CO problems resumes.

2.0201.2 (a,b,c,d,e,f,g) Health and Safety – Combustion Safety – Combustion Safety Testing-General - Combustion Safety (MH)

Gas Range and Oven Safety Testing

- Over-firing, dirt buildup, and foil installed around burners and oven burners obstructed by dirt or foil are likely to produce CO and *must* be tested before and after weatherization by *Certified Weatherization Staff* or *Qualified Heating Technician*. Replacement, repair and cleaning of gas rang and ovens are not eligible expenditures thru the NeWAP.
- Inspect cooking burners for operability and flame quality.
- Test each stove-top burner separately, using a digital combustion analyzer or CO meter and holding the probe about 8 inches above the flame for 2 minutes.
- Turn on the oven to bake at high temperature. Sample the CO level in exhaust gases at the oven vent and in the ambient air after 10 minutes.
- Actions include cleaning the oven, removing aluminum foil, or adjusting the burner's adjustable gas control.
- If the CO reading is over 100 ppm or if the ambient-air reading rises to 35 ppm or more during the test, abort the test and advise the client of hazardous condition. *Deficiencies must be corrected before proceeding with weatherization work can proceed*.
- Provide client with combustion safety and hazards information, including the importance of using exhaust ventilation when cooking and the importance of keeping burners clean to limit the production of CO.
- Advise the client of the following important operating practices;
  - Never install aluminum foil around a range burner or oven burner.
  - Never use a range burner or gas oven as a space heater.
  - Open a window or turn on the kitchen exhaust fan when using the range or oven.

- Keep range burners and ovens clean to prevent dirt from interfering with combustion.
- Burners should display hard blue flames. Yellow or white flames, wavering flames, or noisy flames should be investigated by *a Qualified Heating Technician*.
- Observe the installed CO detector, and discontinue use of the range and oven if the CO level rises above 35 ppm in ambient air.

2.0201.2 (a,b,c,d,e,f,g) Health and Safety – Combustion Safety – Combustion Safety Testing-General - Combustion Safety (MH)

2.0203 Vented Gas Appliances

Inspect, testing, assess and appropriate document information on vented gas appliances within a home to ensure all equipment is operating safely and clients are educated on the proper use of the equipment. To be inspected by Certified *Weatherization Staff*.

2.0203.4 (a,b,c,d,e) Health and Safety – Combustion Safety – Vented Gas Appliances - Combustion Air for Natural Draft Appliances (MH)

2.0203.5 (a,b,c,d,e,f) Health and Safety – Combustion Safety – Vented Gas Appliances - Combustion Flue Gas—*Orphaned* Water Heaters (MH)

2.0203.6 (a,b,c,d,e) Health and Safety – Combustion Safety – Vented Gas Appliances - Draft Regulation—Category I Appliance (MH)

Isolation of Water heater Closets form *Conditioned Space*s in Manufactured Housing

- Prevent combustion gases from entering *Living area* and minimize interior pressures caused by equipment and conditions in the water heater closet.

2.0204.1 (a,b,c,d) Health and Safety – Combustion Safety – Isolation Isolating Combustion Water Heater Closet (MH)

2.0299 Additional Resources

2.0299.1 (a,b,c,d,e,f,g,h,I) Health and Safety – Combustion Safety – Combustion Appliance Depressurization Limits Table (MH)

2.03 Safety Devices

2.0301 Combustion Safety Devices

- Provide the client with verbal and written information on the use of CO detectors.

2.0301.1 (a,b) Health & Safety –Safety Devices – Combustion Safety Devices – Smoke Alarm (SF) (MH)

2.0301.2 (a,b) Health & Safety –Safety Devices – Combustion Safety Devices – Carbon Monoxide Alarm or Monitor (SF) (MH)

2.04 Moisture

2.0401 Air Sealing

2.0403 *Vapor barriers*

The NeWAP requires a full ground laid moisture barrier be installed whenever possible in accessible crawlspaces except when one exists or the space has a concrete floor.

Ground Moisture Barrier Installation Standards

- The moisture barrier must be a Class I *Vapor retarder*, a minimum of 6 mils thick, extended up the walls and the support columns at least 12 inches and the joints must overlap a minimum of 12 inches.
- In the event the entire floor cannot be covered, all accessible areas must receive a moisture barrier.
- When installing insulated skirting without adequate clearance to install a full ground laid moisture barrier, the moisture barrier must extend a minimum of 24 inches beyond the insulation.

2.0401.1 (a,b,c,d) Health & Safety – Moisture - Air Sealing – Air Sealing Moisture Precautions (SF) (MH)

2.0403.1 (a,b,c,d,e) Health & Safety – Moisture— *Vapor barriers* — Vented *Crawl Spaces* – Ground Moisture Barriers (SF)

2.0403.2 (a,b,c,d,e,f,g,h,i) Health & Safety – Moisture— *Vapor barriers* — Closed *Crawl Spaces* – Ground Moisture Barriers (SF)

2.0403.4 (a,b,c,d) Health & Safety – Moisture – *Vapor barriers* – Pier and Skirting Foundations – Ground Moisture Barriers (MH)

2.06 Electrical

2.0601 Knob and Tube Wiring

- The Nebraska State Electrical Board does not permit directly covering knob and tube wiring with insulation. Subgrantees ***must*** comply with the following fire and electrical safety procedures before insulating.
- Attic areas with knob-and-tube wiring that are indicated as cost-effective for implementation must be insulated after the wiring has been appropriately covered to prevent direct contact with the insulation and to provide adequate air space (a minimum of 3 ½" clearance) for "cooling" of the wire.
- Appropriate shielding materials for concealing the knob-and-tube wiring *must* include gypsum board (5/8" or thicker), plywood or oriented strand board.

  4.1001.2 (a,b,c) - Insulation – Attics— General Preparation— Knob and Tube Wiring (SF)
- Attics where Knob-and-Tube Wiring has been previously covered with insulation that is cost-effective to install additional insulation, must be insulated when it has been determined where the wiring is located and that it is actually still "active".
- Once the determination of the wire locations is documented in the client file, the wiring must be appropriately shielded to prevent direct contact with the additional insulation and to provide adequate air movement space for cooling of the wire, then insulated.
- In attic areas where knob-and-tube wiring penetrates the plane of the attic and extends up into a side or knee wall, a fire resistant baffling must be installed around the wire to provide sufficient space for air movement around the wire to provide adequate air space to accommodate the cooling of the wire, then insulated.
- Existing fuses must remain intact if no insulation is being completed in the home.

2.0602 Electric Hazards

2.0602.1 (a,b) Health and Safety – Electrical – Electrical Hazard - Static Electric Shock (MH)

2.0602.2 (a,b,c,d) Health and Safety – Electrical – Electrical Hazard - House Current Electric Hazard (MH)

2.07 Occupant Education and Access

2.0701 *Basements* and *Crawl Spaces*

2.0701.2 (a,b,c) Health and Safety – Occupant Education and Access – *Basement* and *Crawl Spaces* - *Crawl Space* Information Sign (SF)

2.0701.3 (a,b,c) Health and Safety – Occupant Education and Access – *Basement* and *Crawl Spaces* - *Crawl Space*—Occupant Education (SF)

2.0702 Installed Equipment

2.0701.3 (a,b,c) Health and Safety – Occupant Education and Access – Installed Equipment — Warranty and Service Agreement (SF)

2.08 DOE Health and Safety Program Guidance Requirements

2.0801 Air Conditioning and *Heating Systems*

Action/Allowability

- "Red tagged", inoperable or non-existent ***Heating System*** replacement, repair, or installation ***is*** an allowable Health & Safety Cost. Repair of **air conditioning** systems ***is*** an allowable Health & Safety Cost. Replacement or installation of **air conditioning** system ***is not*** an allowable Health & Safety Cost.

Testing

- Make sure systems are present, operable, and performing. Determine presence of at-risk occupants.

Client Education

- Discuss and provide information on appropriate use and maintenance of units.

Training

- Awareness of guidance.

2.0802 Appliances and Water Heaters

Action/Allowability

- Replacement, repair and cleaning of **water heaters** are allowed ***on a case by case basis*** as a Health & Safety Cost. Repair, installation and cleaning of **other appliances** are ***not*** allowable Health & Safety costs.

Testing

- Determine whether appliances/water heaters are performing safely. Combustion safety testing is required when combustion appliances are present.

Client Education

- Discuss and provide information on appropriate use, maintenance, and proper disposal of appliances/water heaters.

Training

- Awareness of guidance, conduct diagnostic training.

2.0107.1 (a) Health & Safety –Safe Work Practices - Baseload – Baseload Worker Safety (SF)

ASBESTOS

WAP staff members often encounter asbestos siding or in pipe or furnace coverings, in vermiculite mined from areas known to contain asbestos, or even in some textured paints and interior finishes.

2.0100.1 (o) Health & Safety – Global Worker Safety – Safe Work Practices – Asbestos-Containing Materials (SF)

2.0104.1 (b) Health & Safety – Safe Work Practices – Insulation Worker Safety (SF) (MH)

2.0105.2 (c) Health & Safety –Safe Work Practices – Heating and Cooling Equipment – Asbestos (SF)

2.0105.4 (c) Health & Safety –Safe Work Practices – Heating and Cooling Equipment – Asbestos (MH)

2.0803 Asbestos in Siding, Walls, Ceilings, Etc.

When asbestos siding is present it may be removed and replaced, but it must not be cut, sanded, or drilled.

General Information:

- The costs associated with asbestos testing, remediation or removal ***are not*** eligible expenditures in the Nebraska Weatherization Assistance Program. If the presence of asbestos has been previously

confirmed or if the Subgrantee believes that the siding may contain asbestos:
    - Removal of siding is allowed to perform energy conservation measures; however precautions must be taken not to damage the siding. Asbestos siding should never be cut, sanded or drilled. Where possible, insulate the exterior walls through home interior.
  - Inspect exterior wall surface and subsurface for possible asbestos siding prior to drilling or cutting.
  - Blower door testing ***must not*** be completed on homes where asbestos that has been disturbed is determined to be present by an appropriately trained crew leader, auditor or inspector or where testing has been completed verifying the presence of asbestos.
  - Documentation regarding the presence of disturbed asbestos material by an appropriately trained crew leader, auditor or inspector or testing ***must*** be maintained in the client file.

Training Requirements:

- Crew leaders, auditor and inspectors ***must*** be trained on how to recognize asbestos through an AHERA or other appropriately trained or certified asbestos control professional training.
- Cost incurred by sub-grantees to comply with asbestos training requirements ***may*** be charged to the Health and Safety budget category.

Client Education:

- Inform the client that suspected asbestos siding maybe present and how precautions will be taken.

2.0804 Asbestos in Vermiculite

General Information:

- When vermiculite insulation is discovered precautions must be taken. The costs associated with asbestos testing, remediation or removal ***are not*** eligible expenditures in the Nebraska Weatherization Assistance Program.
- If the presence of asbestos has been previously confirmed or if the Subgrantee believes that vermiculite insulation is present:
    - The Sub-grantee ***must*** take precautionary measures as if it contains asbestos, such as not using blower door tests and utilizing personal air monitoring while in attics.
    - When blower door tests are performed, it ***must*** be performed using pressurization instead of depressurization.
- Removal of vermiculite insulation ***is not*** allowed.
- Blower door testing ***must*** be completed on homes where vermiculite asbestos is determined to be present by using the door to establish a **positive** pressure for testing.
- Documentation regarding the presence of asbestos material by an appropriately trained crew leader, auditor or inspector or testing ***must*** be maintained in the client file.

Training Requirements:

- Crew leaders, auditor and inspectors ***must*** be trained on how to recognize asbestos through an AHERA or other appropriately trained or certified asbestos control professional training for encapsulation.
- Cost incurred by sub-grantees to comply with asbestos training requirements may be charged to the Health and Safety budget category. Clients should be instructed not to disturb suspected asbestos containing material.

Client Education:

- Provide asbestos safety information to the client.

2.0805 Asbestos on Pipes, Furnaces, other Small Covered Surfaces

General Information

- The costs associated with asbestos testing, encapsulation, remediation or removal ***are not*** eligible expenditures in the Nebraska Weatherization Assistance Program. If the presence of asbestos has been previously confirmed or if the Subgrantee believes that the pipe insulation may contain asbestos:
  - Sub-grantees ***must*** assume asbestos is present and not disturb the covering materials.
  - Blower door testing ***must not*** be completed on homes where asbestos that has been disturbed is determined to be present by an appropriately trained crew leader, auditor or inspector or where testing has been completed verifying the presence of asbestos.
- Documentation regarding the presence of disturbed asbestos material by an appropriately trained crew leader, auditor or inspector or testing ***must*** be maintained in the client file.

Training Requirements:

- Crew leaders, auditor and inspectors ***must*** be trained on how to recognize asbestos through an AHERA or other appropriately trained or certified asbestos control professional training for encapsulation.
- Cost incurred by sub-grantees to comply with asbestos training requirements may be charged to the Health and Safety budget category. Clients should be instructed not to disturb suspected asbestos containing material.

Client Education:

- Provide asbestos safety information to the client.

2.0806 Biological and Unsanitary Conditions

General Information:

- Addressing bacteria, viruses biological and/or unsanitary conditions ***is not*** an allowable activity. Removal is not a Weatherization responsibility.

Deferral Requirements:

- May be necessary in cases where a known agent is present in the home that may create a serious risk to occupants or weatherization workers.

Client Education:

- Inform client of observed conditions.
- Provide information on how to maintain a sanitary home, steps to correct deferral conditions and the impact on the safety of Weatherization workers who come into contact with these conditions.

2.0807 Building Structure and Roofing

Program workers frequently encounter homes in poor structural condition; however building rehabilitation is beyond the scope of the Weatherization Assistance Program. Weatherization services ***may*** be delayed until the dwelling can be made safe for crews and occupants. Incidental repairs necessary for the effective performance or preservation of weatherization materials are allowed.

Deferral Requirements:

- Building structure rehabilitation and roofing is beyond the scope of the Weatherization Assistance Program.

Client Education:

- Notify client of structurally compromised areas.

2.0808 Code Compliance

The Nebraska Weatherization Program does not fund the costs of bringing homes "up to" the latest building code requirements. However, any eligible energy efficiency work that is completed as part of the weatherization work must meet all state and local building code requirements.

General Information:

- The costs associated with building rehabilitation work that is not specifically associated with the implementation of a cost-effective, approved Weatherization Measure is beyond the scope of the Weatherization Assistance Program.
- It is each sub-grantee's responsibility to ensure that weatherization-related work conforms with the applicable codes in jurisdictions where the work is being performed. Examples of eligible costs associated with cost-effective Weatherization Measures include, but are not limited to: window replacements that provide appropriate *Egress* and glass safety requirements, door replacements that provide appropriate minimum clear width for exiting, the installation of fans to provide appropriate ventilation in the home, appropriate disconnect switching and clearance requirements on furnace installations, etc. Costs associated with the purchase of any required permits are eligible. The cost of the permits ***must not*** be passed onto the client.

Client Education:

- Inform client of observed code non-compliance issues.

2.0809 Carbon Monoxide

Carbon Monoxide (CO) is released by combustion appliances, automobiles, and cigarettes as a product of incomplete combustion. CO is normally tested in the flue of vented appliances. CO is usually caused by one of the following:

- Overfiring
- Backdrafting of combustion gases smothering the flame
- Flame interference with an object
- Inadequate combustion air
- Moving air flame interference
- Misalignment of the burner

General Information:

- A carbon monoxide (CO) test ***must*** be performed on all naturally drafting or induced draft combustion appliances, including cooking stoves, at the time of the initial and *Quality Control Inspections*. The CO levels ***must*** be tested in the undiluted flue gases. CO tests ***must not*** be performed on solid fuel burning appliances.
- If CO levels exceed 100-ppm as measured in the undiluted flue gases or 35-ppm in the ambient air at the time of the initial inspection, weatherization ***must not*** proceed until the CO levels have been reduced.
- Installation of Carbon Monoxide Detectors is required when detectors are not present or are inoperable and a combustion appliance(s) is present.
- *Unsafe water heaters* that cannot be repaired ***must*** be replaced. Replacement is allowed ***on a case by case basis with Nebraska Energy Office approval*** if:
  - the unit's CO levels exceed 100-ppm as measured in the flue gases or 35-ppm in the ambient air at the time of the initial inspection and the CO levels cannot be reduced,
  - the unit has scorch marks that indicate past backdrafting occurrences, or the integrity of the water tank has been compromised as shown by signs of leakage.

Deferral Requirements:

- The *building envelope* ***must not*** be weatherized if the owner or client refuses a *Safety Inspection* of the *Heating System* or until any *Heating System* deficiency has been repaired and/or the *Heating Plant* replaced.
- Mobile homes that have non-mobile home combustion water heaters.
- Mobile homes that have non-mobile

Client Education:

- Provide client with combustion safety and hazards information, including the importance of using exhaust ventilation when cooking and the importance of keeping burners clean to limit the production of CO.
- Provide client with verbal and written information on the use of the CO detector.

2.0810 Combustion Appliance Testing

General Information:

- Prior to weatherizing the *building envelope*, all *Eligible Heating Plants* over two (2) years of age that have not received a *Safety Inspection* during the twelve (12) months prior to the initial inspection ***must*** be inspected by a *Qualified Heating Technician*, utility company or *certified weatherization staff*.
- A backdraft test ***must*** be performed at the time of Initial Inspection, the Quality Control and at the end of each work day if the project will require more than one day, on all vented naturally drafting combustion appliances.
- A backdraft test ***must not*** be performed on solid fuel burning appliances.
- Combustion safety testing is required when combustion appliances are present.
- Inspect venting of combustion appliances and confirm adequate clearances.
- Test naturally drafting appliances for draft and spillage under worst case conditions before and after air tightening.

  2.0203.3 (a,b,c,d,e) Draft Regulation—Category I Appliance (SF)
  2.0299.1 (a,b,c,d,e,f,g,h,i) Combustion Appliance Depressurization Limits Table (SF)
- Inspect cooking burners for operability and flame quality.
- The State of Nebraska's annual heating degree day normal, over the thirty year period from 1971-2000 is 6525, with January Mean °F temperatures that range from 23.2 in the warmest areas of the state to 22.8 in the coldest areas. Clients in units that contain *Heating Plants* that are inoperable or red-tagged are in danger of frost bite, hypothermia and other life threatening issues. Therefore units that contain *Heating Plants* that are inoperable or red-tagged at the time of the initial inspection ***must not*** be weatherized until the *Heating Plant* has been repaired or replaced.
- *Eligible Heating Plants* that cannot be repaired ***must*** be replaced.
- The replacement *Heating Plant* ***must*** be properly vented. If the new *Heating Plant* will not be vented through the masonry chimney, but the water heater will still be vented through that chimney, a properly sized flue liner ***must*** be installed. As an alternative, a power vent may be installed on the water heater.

  2.0203.2 (a,b,c,d,e,f,g) Combustion Flue Gas—*Orphaned* Water Heaters (SF)
- If a dwelling is heated by *Unvented Combustion Space Heaters* and an inoperable conventional *Heating System* is present, the conventional *Heating System* ***must*** be repaired or replaced to eliminate the need for unvented space heaters. If the need for *Unvented Combustion Space Heaters* cannot be eliminated, the sub-grantee ***must*** instruct the client regarding the dangers of carbon monoxide and excessive moisture levels, particularly if any *unvented space heaters* are left in the dwelling as a secondary *Heat Source*, or emergency back-up.

2.0202.1 (a,b) Health and Safety – Combustion Safety – Unvented Space Heaters - Unvented Space Heaters: Propane, Natural Gas, and Kerosene Heaters (SF) (MH)

- If a dwelling utilizes *Unvented Combustion Space Heaters* as the primary *Heat Source*, the *Unvented Combustion Space Heaters* ***must*** be replaced with a vented combustion *Heating System*.

  2.0202.1 (a,b) Health and Safety – Combustion Safety – Unvented Space Heaters - Unvented Space Heaters: Propane, Natural Gas, and Kerosene Heaters (SF) (MH)
- Existing unvented gas clothes dryers ***must*** be vented to the exterior. Gas dryer vent pipe ***must not*** be installed with sheet metal screws, rivets or other intrusive fasteners that will collect lint.
- Installation of Carbon Monoxide Detectors, as per manufacturer's instructions, is required on initial inspection when a combustion appliance(s) is present.
- Propane gas detectors ***must*** be installed in homes and mobile homes on permanent foundations that have propane combustion appliances. The gas detectors ***must*** be permanently installed according to the manufacturer's instructions and 110 volts.

  2.0203.1 (a,b) Combustion Air for Natural Draft Appliances (SF)

Deferral Requirements:

- The *building envelope* ***must not*** be weatherized if the owner or client refuses a *Safety Inspection* of the *Heating System* or until any *Heating System* deficiency has been repaired and/or the *Heating Plant* replaced.
- Mobile homes that have non-mobile home combustion water heaters.
- Mobile homes that have non-mobile home or incorrectly installed solid fuel combustion *Heating System*s.

Client Education:

- Provide client with combustion safety and hazards information, including the importance of using exhaust ventilation when cooking and the importance of keeping burners clean to limit the production of CO.
- Provide client with verbal and written information on the use of the CO detector.

  2.0105.1 (b) Health & Safety –Safe Work Practices – Heating and Cooling Equipment – Carbon Monoxide (SF)

  2.0105.4 (f) Health & Safety –Safe Work Practices – Heating and Cooling Equipment – Carbon Monoxide (MH)

2.0811 Drainage - Gutters, Down spouts, Extensions, Flashing, Sump Pumps, Landscape, Etc.

Alleviating drainage issues is beyond the scope of the Nebraska WAP, however the following issues should be considered during the initial inspection and implementation of the work if drainage issues are encountered and presented to the client or home owner:

- A missing or malfunctioning sump pump: they are often the most effective solution when ground water continually seeps into a *Basement* or *Crawl Space* and collects there as standing water. Serious groundwater problems may require excavating and installing drain pipe and gravel to disperse accumulations of groundwater between a home and nearby hillside.
- Rainwater flowing from roofs often plays a major role in dampening foundations. Installing rain gutters with downspouts that drain roof water away from the foundation can alleviate the moisture.
- Excessive watering around the home's perimeter. Watering lawns and plants close to the house can dampen its foundation. Keeping shrubbery away from the foundation allows the wind circulation near the foundation.
- Preventing moisture problems is the best way to guarantee a building's durability and its occupant's respiratory health.

Deferral Requirements:

- Major drainage issues are beyond the scope of the Weatherization Assistance Program.
- Homes with conditions that may create a serious health concern should be deferred.

Client Education:

- Inform client of any observed conditions regarding minor drainage issues.
- Provide guidance on the importance of cleaning and maintaining gutters and drainage systems and the impact on mold and moisture issues in the home when the drainage systems are not maintained.

ELECTRICAL ISSUES

The two primary energy-related health and safety electrical concerns associated with weatherization work are insulating homes that contain knob-and-tube wiring and identifying overloaded electrical. Electrical safety is a basic need that impacts home weatherization and repair.

2.0812 Knob & Tube Wiring

General Information:

The State Electrical Board does not permit directly covering of knob-and-tube wiring with insulation.

- Knob-and-tube wiring in sidewalls *must not* be covered by new insulation. If knob-and-tube wiring in walls is covered by existing insulation, additional insulation *must not* be installed.
- Knob-and-tube wiring in attics *must not* be directly covered with insulation. Attic insulation may be installed where the knob-and-tube wiring has been concealed in a hollow space that provides adequate ventilation space (a minimum of 3 ½" clearance) to alleviate overheating issues.
- If knob-and-tube wiring is covered by existing insulation, additional insulation *must not* be installed until or unless the wiring has been located and concealed in a hollow space that provide ventilation space to alleviate overheating issues.
- Appropriate shielding materials for concealing the knob-and-tube wiring *must* include 5/8" or thicker gypsum board, plywood or oriented strand board.

2.0601.1 (a,b,c,d,) Health & Safety – Electrical – Knob & Tube Wiring (SF)

2.0813 Electrical Systems

- Serious electrical hazards exist when gross overloads such as over usage, overloaded outlets and/or oversized fuses are present. Should auditors and crews find such existing problems, they should notify the owner and note the problem in the client file. Weatherization measures that involve the installation of new equipment such as air conditioners, heat pumps or electric water heaters can exacerbate previously marginal overload problems to hazardous levels. Rewiring of a home is outside the scope of the weatherization program.
- Wiring splices ***must*** be enclosed in metal or plastic electrical boxes, fitted with cover plates. Electrical boxes in attics ***must*** be marked with a flag that is visible above the insulation.
- *Type-S-Fuses* must be sized according to the smallest gauge of wire in the circuit to be protected. The following gauge wire requires the following size fuse:

Wire Gauge	Fuse Size
12 gauge wire	20 amp fuse
14 gauge wire	15 amp fuse

- If no insulation is being installed in a home the existing fuses ***must*** remain intact. In homes that utilize fuses where attic insulation is being installed the State Electrical Board recommends the use of a licensed electrician for the installation of safety *Type-S-Fuses* as indicated in the National Electrical Code.

Client Education:

- Provide information to the client on overloading circuits, electrical safety/risks.

Deferral Requirements:

- Homes with conditions that require more than incidental repair should be deferred.
- Voltage drop and voltage detection testing are not allowed.

2.0107.1 (a) Health & Safety –Safe Work Practices - Baseload – Baseload Worker Safety (SF)
2.0602.1 (a,b) Health & Safety –Electrical – Electric Hazards – Static Electric Shock (MH)
2.0602.2 (a,b,c,d) Health & Safety –Electrical – Electric Hazards – House Current Electric Hazard (MH)

2.0814 Fire Hazards

A visual inspection for determining fire hazards ***must*** be completed during the audit and while performing weatherization, and appropriately documented in the client file.

General Information:

- Insulation ***must not*** cover the pressure relief valve, the drip leg, draft hood, burner air inlet, pilot light access door, thermostat control, drain valve or the top of the water heater on natural gas or propane water heaters. Insulation ***must not*** cover the pressure relief valve, the drip leg, high limit switch, or drain valve on electric water heaters. Insulation must cover the top of electric water heaters.
- When adding additional insulation to the attic, shielding ***must*** be installed around heat and high-*Heat Sources*. Shielding ***must*** be metal and kept a minimum of 3" from any *Heat Source* and a minimum of 6" from a high-*Heat Source*. Shielding ***must*** be installed at a height to accommodate the depth of the added insulation. If a masonry chimney has an existing metal or metal asbestos flue liner, the chimney does not need to be shielded.
- Weatherization materials ***must not*** be installed over or adjacent to outlets, switches or junction boxes that contain aluminum wiring. Open wire splices ***must not*** be covered with insulation until they have been enclosed with proper junction boxes.
- If potentially dangerous creosote buildup in chimneys or wood stoves or other deficiencies is identified, up to $500 may be spent to repair the unsafe solid fuel combustion *Heating System*. Weatherization of the *building envelope* ***must not*** proceed until the system has been made safe.
- Pipe wrap ***must not*** be installed if the water heater lacks a pressure relief valve.
- Pipe wrap ***must not*** begin within 2 inches or farther than 4 inches of a flue and/or draft hood.

Client Education:

- Inform client of observed hazards.

2.0815 Formaldehyde, Volatile Organic Compounds (VOCs), and other Air Pollutants

Deferral Requirements:

- If pollutants pose a risk to workers the unit must be deferred.

Client Education:

- Inform client of observed condition and associated risks. Provide client written materials on safety and proper disposal of household pollutants.

2.0816 Injury Prevention of Occupants and Weatherization Workers

Weatherization staff ***must not*** work in unsafe and/or excessively unsanitary conditions. Occupational Safety and Health Administration (OSHA) standards, Construction Trade Safety Standards, as well as company safety standards must be observed by everyone in the NeWAP.

General Information:

- Workers must take all reasonable precautions against performing work on homes that will subject workers or occupants to health and safety risks.

Client Education:

- Inform client of the observed condition and associated risks.

2.0817 Lead Based Paint

Lead-Safe Weatherization (LSW) is a group of safe practices used by weatherization technicians when they suspect or confirm the presence of lead paint. LSW practices are rigorous dust-prevention and housekeeping precautions. LSW is required when workers disturb painted surfaces by cutting, scraping, drilling, or other dust creating activities.

On April 10, 2010, the Environmental Protection Agency (EPA) "Lead; Renovation, Repair and Painting Program" (LRRPP) Final Rule became effective in the Weatherization Program. The Rule requires Certified Renovators to be onboard with sub-grantee crews or contractors, and performing all the EPA required functions on all pre-1978 housing. The U.S. Department of Energy requires sub-grantees to follow specified EPA requirements. By adopting basic safety precautions and Lead Safe Weatherization, workers and the occupants of the homes they weatherize will be protected from lead exposure. The U.S. Department of Energy requires sub-grantees to follow specified EPA and Occupational Safety and Health Administration (OSHA) standards for worker safety.

General Information:

- Sub-grantees ***must*** follow both the EPA's Lead; Renovation, Repair and Painting Program (LRRPP) ***and*** the U.S. Department of Energy's Minimum Standards for Lead Safe Weatherization.
- Appropriate swab testing is allowed.
- Sub-grantees that complete work in homes where there is existing paint is "flaking" are responsible for the appropriate handling and cleaning the existing paint as well as any newly disturbed pain as part of jobsite cleaning. The costs associated with completing this work ***must*** be included in the costs associated with the completion of the weatherization measure and the measure *SIR*. Sub-grantees may choose not to weatherize a dwelling unit if the extent and condition of lead-based paint would potentially create further health and safety hazards.
- Job site set up and cleaning verification is required to be completed by an EPA Certified Renovator.

Training Requirements:

- Weatherization requires all weatherization crews working in pre-1978 housing to be trained in Lead Safe Weatherization (LSW).
- Sub-grantees and all weatherization contractors are required to be trained on the requirements of, and follow, the EPA Lead; Renovation, Repair and Painting Program requirements.

Deferral Requirements:

- When the extent and condition of lead-based paint in the house would potentially create further health and safety hazards, the Sub-grantee will inform the client of the of the issues associated with a deferral in the Weatherization Deferral Notice completed by the Weatherization Representative and signed by the client or building owner.

Client Education:

- Inform client of observed conditions and associated risks.
- All LRRPP Client Protection and Notification processes must be followed.

2.0818 Mold and Moisture

Water moves easily as a liquid or vapor from the ground through porous building materials like concrete and wood. A high groundwater table can channel moisture into a home. The most common ground-moisture source is water vapor rising through the soil or liquid water moving up through the soil by capillary action. To prevent this, all *Crawl Spaces* should have ground moisture barriers.

Installing or improving air barriers and *Vapor barriers* to prevent air leakage and vapor diffusion from transporting moisture into building cavities.

Adding insulation to the walls, floor, and ceiling of a home will keep the indoor surfaces warmer and less prone to condensation. During cold weather, well-insulated homes can tolerate higher humidity without condensation than can poorly insulated homes.

General Information:

Sub-grantees ***must*** ensure that weatherization work is performed in a manner that does not cause or contribute to mold problems, and when the work is performed properly, may alleviate mold conditions.

- All clothes dryers and exhaust fans ***must*** be vented to the exterior.
- A full ground laid moisture barrier ***must*** be installed in accessible *Crawl Spaces* and under mobile and modular homes.
- Mold testing is not an allowable cost.

Client Education:

- Sub-grantees **must** include some form of notification or disclaimer to the client upon the discovery of a mold condition. The notification should include what was or will be done to the house that is expected to alleviate the condition and/or that the work performed should not promote new mold growth. The notification must be signed by the client and the owner (if the client is a renter) and placed in the client file.

Deferral Requirements:

- Where severe Mold and Moisture issues exist that pose a risk to workers, deferral is required. If serious mold conditions are discovered during the initial inspection of the home, the home should be referred to the appropriate public or non-profit agency for remedial action. Weatherization should not be undertaken until the problems have been alleviated. However, weatherization funds may be used to correct energy-related conditions to allow for effective weatherization work and/or to assure the immediate or future health of workers and clients.

2.0501.1 (a,b,c,d) Health & Safety – Moisture – Air Sealing – Air Sealing Moisture Precautions (SF)

2.0403.1 (a,b,c,d,e) Health & Safety – Moisture – *Vapor barriers* – Vented *Crawl Spaces*-Ground Moisture Barrier (SF)

2.0403.2 (a,b,c,d,e,f,g,h,i) Health & Safety – Moisture – *Vapor barriers* – Closed *Crawl Spaces*-Ground Moisture Barrier (SF)

2.0403.4 (a,b,c,d) Health & Safety – Moisture – *Vapor barriers* – Pier and Skirting Foundations-Ground Moisture Barrier (SF)

2.0701.1 (a,b) Health & Safety – Occupant Education and Access – *Basements* and *Crawl Spaces* – *Crawl Spaces*-Providing Access (SF)

2.0819 Occupant Pre-Existing or Potential Health Conditions

All products used in Weatherization Services must be approved by the U.S. Department of Energy. Some products used may have an odor (Volatile Organic Compound or VOC) that some people may find objectionable or to which some people may experience sensitivity. If any family member or a sub-

grantee believes that someone in the home may be hypersensitive to, or may otherwise object to the use in the home of any of the common weatherization building material, the issue must be documented and resolved prior to the start on the work.

General Information:

- When a person's health may be at risk and/or the work activities could constitute a health or safety hazard, the occupant at risk will be required to take appropriate action based on severity of risk.
- Require occupant to reveal known or suspected health concerns as part of initial application for weatherization.
- Screen occupants during audit using the Health & Safety Client Home Screening Questionnaire.

Client Education:

- Provide client information of any known risks.
- Provide worker contact information so client can inform of any issues.

Deferral Requirements:

- Failure or the inability to take appropriate actions must result in deferral.

2.0820 Pests

General Information:

- Screening of windows and points of access is allowed to prevent intrusion

Client Education:

- Inform client of observed condition and associated risks.

Deferral Requirements:

- Infestation of pests may be cause for deferral where it poses health and safety concern for workers.

2.0821 Radon

Radon is a natural radioactive gas found in areas of Nebraska. Radon can't be seen, smelled or tasted and has been linked to certain types of cancers.

General Information:

- In homes where radon may be present, precautions should be taken to reduce the likeliness of making radon issues worse.

Client Education:

- Sub-grantees ***must*** also provide clients with a Nebraska Radon Information Fact Sheet.

2.0822 Refrigerants

Workers facing possible exposer to refrigerants must follow guidelines regarding awareness and wear personal protective equipment such as respiratory protection and chemical protective clothing.

General Information:

- Replaced air conditioners and heat pumps must be properly disposed of and the refrigerant reclaimed in compliance with the Clean Air Act 1990, section 608, as amended by 40 CFR 82, 5/14/93. The vendor, DE manufacturing center or other entity recovering the refrigerant must possess EPA-approved Section 608 type I, II or III universal certification.

2.0823 Smoke, Carbon Monoxide Detectors, and Fire Extinguishers

Some people burn wood, wood pellets, corn or other solid fuels for heat during the winter.

General Information:

- Installation of CO detectors ***is an allowable*** Health & Safety Cost when detectors are not present or are inoperable.

- Replacement of operable CO Detectors is ***not*** an allowable cost.
- The costs associated with the installation of smoke detectors are ***not*** allowable Health & Safety Costs.
- The costs associated with providing fire extinguishers are ***not*** allowable Health & Safety Costs.
- Check for operation of existing CO detectors.

Client Education

- Provide the client with verbal and written information on the use of CO detectors.

Training

- Where to install detectors. Local code compliance.

2.0301.1 (a,b) Health & Safety –Safety Devices – Combustion Safety Devices – Smoke Alarm (SF) (MH)

2.0301.2 (a,b) Health & Safety –Safety Devices – Combustion Safety Devices – Carbon Monoxide Alarm or Monitor (SF) (MH)

2.0824 Solid Fuel Heating

General Information:

- Maintenance, repair and replacement of primary indoor heating units is allowed where occupant health and safety is concerned, with prior Energy Office approval.
- Maintenance and repair of secondary heating units is allowed.

Client Education:

- Provide client with safety information.

2.0105.1 (a,b,c) Health & Safety –Safe Work Practices – Heating and Cooling Equipment – Combustion Worker Safety (SF)

2.0105.3 (a) Health & Safety –Safe Work Practices – Heating and Cooling Equipment – Combustion Worker Safety (MH)

SPACE HEATERS

Space heaters are self-contained devices generally used for heating a specific area. These types of heating devices are often associated with fires and carbon monoxide poisoning risks.

2.0825 Electric Space Heaters

General Information:

- Repair, replacement or installation is not allowed.
- Removal is recommended.
- Check circuitry to ensure adequate power supply for existing space heaters.

Client Education:

- Inform client of hazards and collect a signed waiver if removal is not allowed.

2.0826 *Unvented Combustion Space Heaters*

General Information:

- Removal is required, except as secondary heat where unit conforms to ANSI Z21.11.2.
- Units that do not meet ANSI Z21.11.2 must be removed prior to weatherization but may remain until a replacement *Heating System* is in place.
- Testing for air-free carbon monoxide (CO) is allowed.
- Check units for ANSI Z21.11.2 label.

Client Education:

- Inform client of the dangers of unvented space heaters – CO, moisture, NO2, CO can be dangerous

even if CO alarm does not sound.

2.0202.1 (a,b) Health & Safety –Combustion Safety – Unvented Space Heaters – Unvented Space Heaters: Propane, Natural Gas, and Kerosene Heaters (SF) (MH)

2.0827 Vented Combustion Space Heaters

General Information:

- Should be treated as furnaces.
- Venting should be tested consistent with furnaces.

2.0828 Spray Polyurethane Foams (SPF)

Polyurethane foam is applied with a gun that combines materials at its tip. When combined, these materials make an effective insulator. There are benefits to using spray polyurethane foam, but there are also disadvantages; health risks and environmental impacts when the product is not properly handled, stored, or installed.

General Information:

- Use EPA recommendations when working within the *Conditioned Space* or when SPF fumes become evident within the *Conditioned Space*.
- When working outside the *building envelope*, isolate the area where foam will be applied, take precautions so that fumes will not transfer to inside *Conditioned Space* and exhaust fumes outside the home.
- Check for penetrations in the *building envelope.*

Client Education:

- Provide notification to the client of plans to use two-part foam and the precautions that may be necessary.

2.0829 Ventilation

Ventilation is an important health and safety concern in homes where the blower door reading is low.

2.0106.1 (a) Health & Safety –Safe Work Practices – Ventilation Equipment - Ventilation Worker Safety (SF) (MH)

General Information:

- Exhaust fans must be vented to the outdoors, and never into building attics or crawlspaces. They should have tight-fitting *backdraft dampers*. Low scone (.5) fans should be installed to encourage the client to run them longer, and particularly in those cases where a continuous exhaust fan is installed.
- 2013 (or most current) ASHRAE 62.2 is required when performing weatherization activities.
- Implementing ASHRAE 62.2 is not required where acceptable indoor air quality already exists as defined by ASHRAE 62.2.
- Inadequate fans and blower systems should be updated.

Client Education:

- Provide client with information on function, use, and maintenance of ventilation system and components.
- Include disclaimer that ASHRAE 62.2 does not account for high polluting sources or guarantee indoor air quality.

2.0830 Window and Door Replacement, Window Guards

General Information:

- Replacement, repair, or installation is not an allowable Health and Safety cost but may be allowed as an incidental repair or in conjunction with an energy efficiency measure if cost justified.

Testing:

- Not applicable.

Client Education:

- Provide information on lead risks.

Training:

- Awareness of guidance.

3 AIR SEALING

Air *Infiltration* can account for 30 percent or more of a home's heating and cooling costs and can contribute to additional problems with moisture, noise, dust, indoor air quality, and pests. Appropriate air sealing can reduce *Infiltration* significantly to reduce heating and cooling costs, improve building durability and longevity, and create a healthier indoor environment.

3.01 Identify the Air and Thermal Boundaries of the *Building Envelope*

To complete appropriate air sealing you ***must*** identifying the location of both the air and the thermal boundaries of the home. Generally, ceilings, walls, and floor/foundation separate the inside *Conditioned Space* from the outside or *Unconditioned Space* forming both the air barrier and the thermal barrier for the house, but that is not always the case. For example, the thermal boundary of a home's crawlspace may be insulation located in the floor cavities while the foundation walls actually provide the air barrier. A visual inspection is used to verify the thermal barrier while blower door testing of the *pressure plane*s within the home is one of the most accurate ways of identifying the air boundaries of a home.

3.02 Blower Door Testing

Blower door testing is used to determine the overall air tightness of a home. Appropriate testing can help you to locate leaks, determine approximately how big the leaks are, and whether the leaks are located in areas that may significantly impact the indoor air quality of the home and the health of its residents. Pre- and post-weatherization blower door testing ***must*** be completed on all homes weatherized through the NeWAP. Documentation of the test results ***must*** be appropriately included in all client files.

2.0103.1 (a) Health and Safety – Safe Work Practices– Air Sealing – Air Sealing Worker Safety (SF) (MH)

Air Sealing is most effective when completed in conjunction with the blower door. Utilizing blower door guided air sealing allows you to locate and seal the largest sources of leakage and helps you to determine the effectiveness of your sealing work by providing an instantaneous reduction in the home's CFM^{50} reading. The CFM^{50} reduction should be checked at the end of each air sealing measure or step completed to determine cost effectiveness. As the air sealing work progresses the amount of CFM reduction experienced diminishes, you are able to determine the point where continued air sealing is no longer cost-effective.

Cost Effective Blower Door Guided Air sealing is air sealing guided by calculating effectiveness after each or round of *Infiltration* repair work completed. Dividing the labor and material costs incurred by the CFM^{50} reduction gives dollar/CFM^{50} savings ratio. As long as the dollar/CFM^{50} savings ratio is less

than $40.00 per 100 CFM, continue looking for air sealing opportunities. If the dollar/CFM^{50} ratio is greater than $40.00 per 100 CFM, stop air sealing. *See the example below*.

Example:

First Blower Door Reading:	5500 cfm-50
Air Sealing Work Done:	Close opening above and around interior pocket door and hole in the wall behind the kitchen range
Materials Used:	1/2 sheet of dry wall, ¼ roll R-11 batt, 2 tubes caulking, drywall tape, mud and screws.
Labor Cost:	2.5 hours at $25.00 = $62.50
Material Cost:	$63.00
Total:	$125.50
Second Blower Door Reading:	4100 cfm-50 a reduction of 1400 cfm
Savings Ratio:	$125.50 ÷ 1400 x 100 =$8.96 per 100cfm

The ratio is less than $40 per 100cfm. Keep looking for air sealing opportunities

Second Blower Door Reading:	4100 cfm-50
Air Sealing Work Done:	seal around furnace flue and fire place chimney (at attic insulation line)
Materials Used:	10 SF tin, 6 tubes of high temp caulk, screws, and 1 small "L" bracket to secure tin to masonry chimney
Labor Cost:	3 hours at $25.00 = $75.00
Material Cost:	$140.00
Total:	$215.00
Third Blower Door Reading:	3450 cfm-50 a reduction of 650 cfm
Saving Ratio:	$215.00 ÷ 650 cfm x 100 = $33.07 per 100 cfm

The ratio is less than $40.00 per 100cfm. Keep looking for air sealing opportunities

Third Blower Door Reading	3450 cfm-50
Air Sealing Work Done:	caulk interior window and door trim, install window rope pulley covers, caulk attic access trim
Labor Cost:	2-1/2 hours at $25.00 = $62.50
Material Cost:	11 tubes of caulking @$4.50, 20 pulley covers @$3.50, and 25 feet backer rod @ $1.00 total materials cost $123.50
Total:	$186.00
Fourth Blower Door Reading:	2700 cfm-50 A reductions of 750 cfm
Saving Ratio:	$186.00 ÷ 750 cfm x 100 = $24.80 per 100 cfm

The ratio is less than $40.00 per 100 cfm. Keep looking for air sealing opportunities.

Fourth Blower Door Reading:	2700 cfm-50
Air Sealing Work Done:	Seal rim joist and seal unused coal chute.
Labor Cost:	2 hours at $25.00 = $50.00
Material Cost:	13 tubes of caulking @$4.50, 20 feet of backer rod @$1.00 = total materials $78.50
Total Measure Cost:	$128.00
Fifth Blower Door Reading:	2400 cfm a reduction of 300 cfm

Savings Ratio: $128 ÷ 300 cfm x 100 = $42.65 per 100 cfm

The ratio is more than $40 per 100 cfm. ***Stop*** *air sealing.*

- Air sealing blower door readings should be appropriately recorded in the client file.
- A maximum of $40 in material and labor per 100 CFM^{50} reduction in air leakage is reimbursable through the NeWAP, including the final blower door guided sealing step as indicated above. However, the total ratio for all blower door guided saving steps must not exceed $40 per 100 CFM^{50}.
- NeWAP only provides the $/CFM reduction reimbursement of the costs directly associated with blower door air sealing not with other energy savings measures (i.e. window replacements, attic insulations). Payment for blower door air sealing requires documentation verifying the *Infiltration* reduction costs being reimbursed are directly associated with blower door guided air sealing.

3.03 Primary Air Sealing Guidelines/Requirements

- Seal the largest openings first progressively working to the smaller openings. *Stack Effect* makes it most effective to start air sealing at the top of the structure and work your way down to the lower areas of the home. The following areas/building areas provide special sealing challenges and should always checked in your air sealing process:
  - Plumbing walls and wiring penetrations

    3.1001.4 (a,b,c,d,e,f) Air Sealing – Attics – Penetrations and Chases – General Penetrations (Electrical, HVAC, Plumbing, Vent Termination, Recessed Lighting) (MH)

    3.1301.1 (a,b,c,d,e) Air Sealing – Floors – Penetrations – Electrical, HVAC, Plumbing, Gas, Dryer Vent, and General Penetrations Through Bottom Board (MH)

    3.1301.2 (a,b,c,d,e,f) Air Sealing – Floors – Penetrations – Electrical, HVAC, Plumbing, Gas, Dryer Vent, and General Penetrations Through Flooring (MH)
  - Chase ways around chimneys

    3.1001.1 (a,b,c,d) - High temperature application (SF)
  - Cantilevered floors
  - Kitchen or bathroom soffits

    3.1001.2 (a,b,c,d.e,f) - Non-standard chase (interior walls covered with wood or paneling) (SF)
  - Joints between the porch and the house
  - Balloon framed exterior wall bypasses

    3.1001.3 (a,b,c,d,e) Air Sealing – Attics – Penetrations and Chases - Walls Open to Attic - Balloon Framing and Double Walls (SF)
  - Rim joists
  - Tops and bottoms of interior walls
  - Pocket Door

    3.1201.4 (a,b) Backing and infill (SF)
  - Dropped ceilings

    3.1003.1 (a,b,c,d,e) Air Sealing – Attics – Dropped Ceilings and Soffits – New Ceiling Below Original - Old Ceiling Intact or Repairable (SF)

    3.1003.2 (a,b,c,d,e) Air Sealing – Attics – Dropped Ceilings and Soffits – Ceiling Leaks Not Repairable - No Air Barrier Above (SF)

    3.1003.4 (a,b,c,d,e) Air Sealing – Attics – Dropped Ceilings and Soffits – Dropped Ceilings (SF)

    3.1003.5 (a,b,c) Air Sealing – Attics – Dropped Ceilings and Soffits – Dropped Ceilings with Light

Boxes and Fixtures (SF)

3.1003.6 (a,b,c,d,e) Air Sealing – Attics – Dropped Ceilings and Soffits – Dropped Soffits (SF)

- Joist cavities under *Kneewall*s in *Finished Attics*
- Electrical service entry point as well as wiring/conduit penetrations

3.1001.4 (a,b,c,d,e,f) Air Sealing – Attics – Penetrations and Chases – General Penetrations (Electrical, HVAC, Plumbing, Vent Termination, Recessed Lighting) (MH)

3.1301.1 (a,b,c,d,e) Air Sealing – Floors – Penetrations – Electrical, HVAC, Plumbing, Gas, Dryer Vent, and General Penetrations Through Bottom Board (MH)

3.1301.2 (a,b,c,d,e,f) Air Sealing – Floors – Penetrations – Electrical, HVAC, Plumbing, Gas, Dryer Vent, and General Penetrations Through Flooring (MH)

- Outlet and switchplate insulators may be installed on exterior and interior walls.
- Insulators ***must not*** be installed if the outlet or switch has aluminum wiring.
- Bathtub and shower surrounds

3.1003.3 (a,b,c,d,e) Air Sealing – Attics – Dropped Ceilings - Above closets and tubs (SF)

- Recessed light fixtures

3.1001.4 (a,b,c,d,e,f) Air Sealing – Attics – Penetrations and Chases – General Penetrations (Electrical, HVAC, Plumbing, Vent Termination, Recessed Lighting) – (MH)

- Duct boots and registers

3.1402.1 (a,b,c) Air Sealing – *Basement*s and *Crawl Spaces*- *Basement*s Connected to *Crawl Spaces* – Sealing and Insulating - High Temperature Application (SF)

3.1601.1 (h,i) Air Sealing – Ducts – Duct Preparation – Boot to Wood & Boot to Gypsum (SF)

3.1601.5 (g,h) Air Sealing – Ducts – Duct Preparation – Preparation and Mechanical Fastening - Boot to Wood & Boot to Gypsum (MH)

- Additional challenging sealing points that you should always checked in your air sealing process:

3.1001.1

3.1001.2 (c,d) Air Sealing – Attics – Penetrations and Chases - Chase Capping - Non-standard chase (interior walls covered with wood or paneling) & Support (SF)

3.1004.1 (a,b,c) Air Sealing – Attics – Cathedralized Attic Ceilings – Catedralized Attic Air Sealing (Insulation Installed at Roof Deck) (SF)

3.1005.1 (a,b,c) Air Sealing – Attics – Other Ceiling Materials - Tongue and Grove Ceilings (SF)

3.1402.3 (a,b) Air Sealing – *Basement*s and *Crawl Spaces* - Closed *Crawl Spaces*—Air Sealing Exterior Wall (SF)

3.1501.1 (a,b,c,d,e,f,g) Air Sealing – Attached Garages – Penetrations, Cracks, and Doors Between Garage and House (SF)

3.1101.1 (a,b,c) Air Sealing – Walls – Manufactured Housing Walls - Exterior Holes and Penetrations (MH)

3.1101.2 (a,b,c) Air Sealing – Walls – Manufactured Housing Walls - Interior Holes and Penetrations (MH)

3.1101.3 (a,b,c,d) Air Sealing – Walls – Manufactured Housing Walls – Holes, Penetrations, and Marriage Lines (MH)

3.04 Secondary Air Sealing Guidelines/Requirements

- Should be completed following the implementation of the Audit recommended Energy Efficiency Measures. As with Primary Air Sealing, seal the largest leaks and work your way down to the smaller leaks. And due to *Stack Effect*, it is also most beneficial to start sealing at the

highest level of the home and work your way down. Common secondary air sealing Measures include but are not limited to:

- Adjusting and/or installing door weatherstripping, thresholds and sweeps.
  - **3.1201.3 (a,b,c,d,e) Air Sealing – Windows & Doors – Maintenance, Repair, & Sealing – Exterior Doors (SF)**
- Tightening and/or installing window weatherstripping.
  - **3.1201.1 (a,b,c,d,e,f,g) Air Sealing – Windows & Doors – Maintenance, Repair & Sealing - Double-Hung Wood Windows (SF)**
  - **3.1201.2 (a,b,c,d,e) Air Sealing – Windows & Doors – Maintenance, Repair & Sealing - Single-Unit Window and Fixed Frame with Wood Sash (SF)**
  - **3.1201.5 (a,b,c,d,e,f,g,h) Air Sealing – Windows and Doors - Maintenance, Repair and Sealing (MH)**
  - **3.1202.1 (a,b,c,d) Air Sealing – Windows & Doors – Maintenance, Repair & Sealing- Fixed Frame with Wood Sash—Older House (SF)**
  - **3.1202.2 (a,b,c,d) Air Sealing – Windows & Doors – Maintenance, Repair & Sealing - Single-Unit Window, Mounted on Rough Opening - Newer House (SF)**
  - **3.1202.3 (a,b,c,d,e) Air Sealing – Windows and Doors – Repairing/Replacing Cracked and Broken Glass (MH)**
- Installing switchplate and outlet insulators

3.05 Minor Air Sealing Requirements

- Cracks in exterior window and door frames can be sealed to keep water out.If the crack is deeper than 5/16-inch, it must be backed with an appropriately sized backer rod and then sealed with caulk. Any existing loose or brittle material **must** be removed before the crack is re-caulked.
- Joints in sill plate (mud sill) and around utility openings in foundation ***must*** be sealed.
- Holes and cracks in masonry surfaces may be sealed with a cement-patching compound or mortar mix if blower door testing indicates substantial leakage.
- Interior joints may be caulked if blower door testing indicates substantial leakage. These joints include where baseboard, crown molding and/or casing meet the wall/ceiling/floor surfaces. Gaps around surface-mounted or recessed light fixtures and ventilation fans should also be caulked if appropriate.
  - **3.1402.1 (a,b,c) Air Sealing – *Basements* and *Crawl Spaces* - *Crawl Spaces* - Sealing Floor Penetrations (SF)**

Sub-grantees ***must*** complete all cost-effective air sealing opportunities and all project files ***must*** provide clear and adequate documentation of the installer's efforts to appropriately air seal the home.

Air Sealing Material Standards installed through the NeWAP ***must*** form a permanent and airtight seal, ***must*** match the existing surfaces as closely as possible, and meet the following requirements

- Caulking:
  - ***must*** be paintable and ***must*** be clear or a color complementary to the surface to which it is applied.
  - installed around heat-producing sources ***must*** be specifically manufactured for installation around *Heat Sources*.
- Openings wider than ¼ inch and deeper than 5/16-inch must be packed with material specifically designed as a packing material prior to caulking.

- Packing material ***must*** be compatible with the type of caulking used.
- Expanding and non-expanding foam sealant may be used as an air sealing material.
- If mortar or mortar patch is used, it ***must*** be a color complementary to the surface to which it is applied and be textured to match the surrounding surface as close as possible.
- *Spray-Applied Insulation* may be used as an air sealing material.

Mobile Home Air Sealing Requirements:

- Exterior water heater compartments ***must*** be sealed and isolated from the interior of the home.
- All openings from the water heater compartment into the *Conditioned Space* ***must*** be sealed with metal or 5/8" fire code gypsum board.
- Water heater compartment doors that are beyond repair ***must*** be replaced. Appropriate photo and written documentation regarding the condition of the door ***must*** be included in the client file.

3.06 Air Sealing Exceptions

Some dwellings may not reach the air sealing standards because of structural conditions or other factors. Exceptions are allowed when:

- All reasonable attempts have been made to reach the standard, or
- Further air sealing is not cost-effective

Sub-grantees **must** complete all cost-effective air sealing opportunities and all project files **must** provide clear and adequate documentation of the installer's efforts to appropriately air seal the home.

3.12 Windows and Doors

Window and door replacements can sometimes be replaced based on energy savings, generally replacement is not a cost-effective measure through the NeWAP. However replacements ***may*** be completed if the unit(s) is appropriately documented in the client file as "beyond repair". The NeWAP does cover costs associated with cost-effective repair and air sealing work on exterior doors, exterior windows, storm doors and storm windows. Repairs not specifically associated with cost-effectiveness and air sealing may be completed as an incidental repair.

3.1201 Maintenance, Repair, and Sealing

All work related to window and door repair/replacement ***must*** be completed using lead-safe weatherization practices.

3.1201.1 (a) Air Sealing – Windows & Doors – Maintenance, Repair & Sealing - Double-Hung Wood Windows - Lead paint assessment (SF)

3.1201.2 (a) Air Sealing – Windows & Doors – Maintenance, Repair & Sealing - Single-Unit Window and Fixed Frame with Wood Sash - Lead paint assessment (SF)

3.1202.1 (a) Air Sealing – Windows & Doors – Repairing/Replacing Cracked & Broken Glass - Fixed Frame with Wood Sash—Older House - Lead paint assessment (SF)

3.1202.2 (a) Air Sealing – Windows & Doors – Repairing/Replacing Cracked & Broken Glass - Single-Unit Window, Mounted on Rough Opening - Newer House - Lead paint assessment (SF)

3.1202.3 (b) Air Sealing – Windows & Doors – Repairing/Replacing Cracked & Broken Glass - Single-Unit Window, Mounted on Rough Opening - Newer House - Lead paint assessment (MH)

3.1203.1 (a,b,c,d,e) Air Sealing – Windows & Doors – Replacement – Replacement Windows in Existing Frame - Lead paint assessment (SF)

3.1203.2 (a,b,c,d,e,f) Air Sealing – Windows & Doors – Replacement - Single-Unit Window, Mounted on Rough Opening—Newer - Lead paint assessment House (SF)

3.1203.2 (b) Air Sealing – Windows & Doors – Replacement – Replacement of Manufactured Housing Windows and Doors - Lead paint assessment House (MH)

3.1202 Window and Door Repairing/Replacing Cracked and Broken Glass

Window replacements completed through the NeWAP must be shown as cost-effective through the home's Energy Audit, unless the unit(s) is documented in the client file as beyond repair. However windows in many homes are a major source of air leakage, therefore repair and air sealing work on exterior and storm windows is an eligible expenditure. This work includes, but is not limited to:

- Replacing or repairing cracked, missing or broken glass using glazing compound and glazing points.
- Replacement window glass must not be less than "B" grade single strength.
- Window glass over 40 inches in either dimension must not be less than "B" grade double strength.
- Window glass must be secured with glazing points and glazing compound, if necessary and the glazing must completely cover the channel.
- Damaged decorative window glass must be replaced with a standard glass pane.
- If the client refuses a standard window glass pane, the decorative window glass must be repaired with clear silicone caulk or a material specifically designed to repair glass.
- If the existing window glass is a thermal pane or *Insulated Glass* and the interior or exterior pane is cracked, the cracked glass must be repaired.
- If the interior and/or exterior panes of thermal pane window glass are broken, the window glass must be replaced with a thermal pane glass whenever possible.
  - **3.1202.1 (a,b,c,d) Air Sealing – Windows & Doors – Replacement – Replacement Window in Existing Window Frame Air Sealing – Windows & Doors – Repairing/Replacing Cracked & Broken Glass - Fixed Frame with Wood Sash—Older House (SF)**
  - **3.1202.2 (a,b,c,d) Air Sealing – Windows & Doors – Repairing/Replacing Cracked & Broken Glass - Single-Unit Window, Mounted on Rough Opening—Newer House (SF)**
- Applying sealants with rated adhesion and movement characteristics to prevent air leakage, condensation, and rain leakage between the window frame and other building materials.
- Replacing missing or severely deteriorated window frame components that are beyond repair.
  - **3.1201.1 (d) Air Sealing – Windows & Doors – Maintenance, Repair & Sealing - Double-Hung Wood Windows - Replacement sills (SF)**
  - **3.1201.1 (e) Air Sealing – Windows & Doors – Maintenance, Repair & Sealing - Double-Hung Wood Windows – Sash replacement (SF)**
- Apply one coat of primer and one coat of exterior paint, as per manufacturer's installation requirements, to all new wood exposed to the weather.
- Adjusting window stops to reduce leakage between the stop and the jamb and ensuring that the window operates smoothly.
  - **3.1201.1 (f) Air Sealing – Windows & Doors – Maintenance, Repair & Sealing - Double-Hung Wood Windows – Adjust stops (SF)**
- Weatherstripping sashes and sills.
  - **3.1201.1 (b) Air Sealing – Windows & Doors – Replacement – Replacement Window in Existing Window Frame – Weather stripping (SF)**
- Replacing or repairing missing or non-functional top and side sash locks, hinges or other hardware.

Door Repair and Air Sealing

Door replacements can sometimes be replaced based on energy savings; generally replacement is not a cost-effective measure through the NeWAP. Replace doors only when the replacement provides an *SIR* of 1.0 or the door is damaged beyond repair and its condition has been appropriately documented. However doors in many homes are a major source of air leakage, therefore repair and air sealing work on exterior doors is an eligible expenditure. This work includes, but is not limited to:

- installing or removing and replacing weatherstripping, thresholds, door bottoms and door sweeps
  - Weather-strips, thresholds, door bottoms and sweeps must have a vinyl or silicone insert.
  - Weather-strips and sweeps must have the last fastener or screw no more than 2-1/2 inches from the end.
- adjusting door hardware to reduce air leakage

  3.1201.3 (b) Air Sealing – Windows & Doors – Maintenance, Repair, & Sealing – Exterior Doors - Door operation and fit (SF)

  3.1201.5 (d) Air Sealing – Windows & Doors – Maintenance, Repair, & Sealing – Manufactured Housing Windows and Doors – Air *Infiltration* (MH)
- applying sealants with rated adhesion and movement characteristics to prevent air leakage, condensation, and rain leakage

  3.1201.3 (c, d) Air Sealing – Windows & Doors – Maintenance, Repair, & Sealing – Exterior Doors (SF)

  3.1201.3 (d,e) Air Sealing – Windows & Doors – Maintenance, Repair, & Sealing – Exterior Doors (MH)
- installing a peephole or door light, located for client use, with the client's permission.
- repairing or replacing broken or missing storm door glass and door glass
  - Replacement door glass must not be less than "B" grade single strength.
  - Door glass over 40 inches in either dimension must not be less than "B" grade double strength.
  - Door glass over 1 sq. ft. must be *Safety Glass*.
  - Door glass must be secured with glazing points and glazing compound, if necessary and the glazing must completely cover the channel.
  - Damaged decorative door glass must be replaced with a standard glass pane.
  - If the client refuses a standard door glass pane, the decorative door glass must be repaired with clear silicone caulk or a material specifically designed to repair glass.
  - If the existing door glass is a thermal pane or *Insulated Glass* and the interior or exterior pane is cracked, the cracked door glass must be repaired.
  - If the interior and/or exterior panes of door glass are broken, the door glass must be replaced. Glass over 1 sq. ft. must be replaced with *Safety Glass* and 1 sq. ft. or less must be replaced with a standard glass pane.

    3.1201.3 (a) Air Sealing – Windows & Doors – Maintenance, Repair, & Sealing – Exterior Doors - Lead paint assessment (SF)

    3.1201.5 (b) Air Sealing – Windows & Doors – Maintenance, Repair, & Sealing – Manufactured Housing Windows and Doors – Lead paint assessment (MH)

- Water heater compartment doors, on mobile homes, that are beyond repair must be replaced. Appropriate photo and written documentation regarding the condition of the door ***must*** be included in the project file.

3.1203 Window and Door Replacement Requirements

Window Replacement Requirements

Window can sometimes be replaced based on energy savings, generally replacement is not a cost-effective measure through the NeWAP. Replace windows only when the window achieves an *SIR* of 1.0 or better when evaluated under the "Evaluate All" Replacement Option or the when the window is damaged beyond repair and its condition has been appropriately documented. Windows replaced through the NeWAP in framed or modular homes, or multifamily buildings ***must*** have:

- an NFRC (National *Fenestration* Rating Council) tested U-factor of 0.33 or lower.
- damaged framing repaired prior to the installation of the new window.
- the cavities around the window frame insulated and sealed with non-expanding foam sealant.
- the existing casing reinstalled if it is in good condition.
- all new casings matched as closely as possible to the existing in design and dimension.
- any interior and/or exterior walls damaged when replacing the window, repaired with like materials.
- new sash sections match, as closely as possible, the existing in design.
- new sash lock(s) installed, if the existing sash was equipped with a sash lock.
- a new sash lock installed, if both the upper and lower sash are replaced.
- Jamb liners may be installed.

3.1201.1 (a,b,c,d,e) Air Sealing – Windows & Doors – Replacement – Replacement Window in Existing Window Frame (SF)

3.1201.2 (a,b,c,d,e,f) Air Sealing – Windows & Doors – Replacement – Single-Unit Window, Mounted on Rough Opening - Newer House (SF)

Windows replaced in mobile homes through the NeWAP ***must*** have:

- an NFRC (National *Fenestration* Rating Council) tested U-factor of 0.33 or lower.
- existing putty tape removed and new putty tape or caulking installed.
- a drip cap installed above non-*mobile home* replacement windows.
- all interior window casings caulked.
- damaged framing repaired prior to installing the new window.
- the cavities around the window frame insulated and sealed with non-expanding foam sealant.
- the existing casing reinstalled if it is in good condition.
- all new casings matched, as closely as possible, to the existing in design and dimension.
- any interior and/or exterior walls damaged when replacing the window, repaired with like materials.
- new sash sections match, as closely as possible, the existing in design.
- new sash lock(s) installed, if the existing sash was equipped with a sash lock.
- a new sash lock installed, if both the upper and lower sash are replaced.
- If the exterior walls in the mobile home will accept house type replacement windows, they may be installed.
- Jamb liners may be installed.

3.1203.3 (a,b,c,d,e,f,g) Air Sealing – Windows & Doors – Replacement – Replacement of Manufactured Housing Windows and Doors (MH)

Storm Window and Screen Repair and Replacement

Storm window and screen replacements are generally not cost-effective energy conservation measures. Replace storm windows only if they are indicated as cost-effective by achieving an *SIR* of 1.0 or better when evaluated under the "Evaluate All" Replacement Option.

- Storm windows repaired or replaced through the NeWAP in single family homes, *Manufactured Homes* and *Multi-family Buildings* ***must not*** be installed over fixed windows.
- Screens may be repaired or replaced as incidental repair.

Storm windows replaced through the NeWAP in mobile homes ***must*** have:

- one-light storms fastened with clips, full-length magnetic strips or using other means that completely seals the window and allow for easy attachment and/or removal.
- self-storing storms in aluminum frame combination windows.
- the storm window installed with a screen insert if the primary window lacks a screen.

3.1201.6 (a,b,c,d,e) Air Sealing – Windows & Doors – Maintenance, Repair & Sealing – Interior Storms (MH)

Door Replacement

Door replacements can sometimes be replaced based on energy savings; generally replacement is not a cost-effective measure through the NeWAP. Replace doors only when the replacement provides an *SIR* of 1.0 or the door is damaged beyond repair and its condition has been appropriately documented. Exterior doors replaced through the NeWAP single family homes or *Multi-family Buildings* ***must*** have:

- replacement doors that are solid core wood, insulated or pre-hung metal insulated doors. Pre-hung metal insulated doors must be R-7 or greater.
- existing locksets reinstalled on the new door, if possible.
- two (2) keys provided to the client, if a new lockset is installed.
- any safety lock installed on the existing door removed and reinstalled on the new door.
- the existing casing reinstalled if it is in good condition.
- all new casings matched, as closely as possible, to the existing in design and dimension.
- the cavities around the door frame insulated and sealed with non-expanding foam sealant.
- door lights with un*Insulated Glass* not to exceed 1 square foot.
- door lights with *Insulated Glass* not to exceed 2 square feet.
- all door casings caulked.
- doors that conform to the thickness of the existing jamb.
- three hinges.
- the door bottom trimmed at a 5 degree angle, if trimming is necessary.
- weather-strips, thresholds, door bottoms and sweeps with a vinyl or silicone insert.
- weather-strips and sweeps with the last fastener or screw no more than 2-1/2 inches from the end.
- minor door adjustments such as tightening the hinges or adjusting the strike plate, completed to ensure proper operation.

3.1201.3 (a,b,c,d,e) Air Sealing – Windows & Doors – Maintenance, Repair, & Sealing – Exterior Doors (SF)

Exterior doors replaced through the NeWAP in *Manufactured Homes* ***must*** have:

- replacement doors that are solid core wood, insulated or pre-hung metal insulated doors. Pre-hung metal insulated doors must be R-7 or greater.
- a gutter, flashing or a drip cap must be installed.
- existing locksets reinstalled on the new door, if possible.

- two (2) keys provided to the client, if a new lockset is installed.
- any safety lock installed on the existing door removed and reinstalled on the new door.
- the existing casing reinstalled if it is in good condition.
- all new casings matched, as closely as possible, to the existing in design and dimension.
- the cavities around the door frame insulated and sealed with non-expanding foam sealant.
- door lights with un*Insulated Glass* not to exceed 1 square foot.
- door lights with *Insulated Glass* not to exceed 2 square feet.
- all door casings caulked.
- doors that conform to the thickness of the existing jamb.
- three hinges.
- the door bottom trimmed at a 5 degree angle, if trimming is necessary.
- weather-strips, thresholds, door bottoms and sweeps with a vinyl or silicone insert.
- weather-strips and sweeps with the last fastener or screw no more than 2-1/2 inches from the end.
- minor door adjustments such as tightening the hinges or adjusting the strike plate, completed to ensure proper operation.

3.1203.3 (a,b,c,d,e,f,g) Air Sealing – Windows & Doors – Replacement – Replacement of Manufactured Housing Windows and Doors (MH)

Below and Grade Level doors replaced through the NeWAP in single family, *Manufactured Homes, or Multi-family Buildings* ***shall***:

- be constructed of ¾ inch *Pressure Treated* exterior grade plywood.
- be reinforced with 1x4 inch common lumber and insulated with a minimum R-7 rigid insulation and framed with *Pressure Treated* wood, redwood or cedar.
- be attached with a minimum of 2 hinges and a minimum of one latching mechanism.
- be weather-stripped.
- have the bottom of the door appropriately air sealed.
- have a handle on both the interior and exterior of the door.
- have wood or aluminum thresholds.
- be caulked at the sill.
- the door bottom trimmed at a 5 degree angle, if trimming is necessary.
- have weather-strips, thresholds, door bottoms and sweeps with a vinyl or silicone insert.
- have weather-strips and sweeps with the last fastener or screw no more than 2-1/2 inches from the end.
- have minor door adjustments such as tightening the hinges or adjusting the strike plate, completed to ensure proper operation.

3.13 Floors

Air sealing floors separates the inside *Conditioned Space* from the outside or *Unconditioned Space* forming an appropriate air barrier. The following standards must be followed when NeWAP sub-grantees air sealing penetrations in floors:

3.1301.1 (a,b,c,d,e,f) Air Sealing – Floors - Penetrations – Electrical, Plumbing, Gas, Dryer Vent, and General Penetrations Through Bottom Board (MH)

3.1302.1 (a,b,c,d,e) Air Sealing – Floors – Floor Framing—Bay Window (MH)

3.14 *Basement*s and *Crawl Spaces*

Air sealing *Basements* and *Crawl Spaces* separates the inside *Conditioned Space* from the outside or *Unconditioned Space* forming an appropriate air barrier. The following standards must be followed when NeWAP sub-grantees air seal penetrations in *Basements* and *Crawl Spaces* or when the following special conditions are encountered:

3.1401 *Basement*s Connected to *Crawl Spaces* or *Ledged Basement*s

3.1401.1 (a,b,c,d) Air Sealing – *Basement*s and *Crawl Spaces* – *Basement*s Connected to *Crawl Spaces* (SF)

3.1402 *Crawl Spaces*

3.1402.2 (a) Air Sealing – *Basement*s and *Crawl Spaces* – *Crawl Spaces* - Closed *Crawl Spaces*-Air Sealing Foundation Vents (SF)

3.1402.3 (a,b) Air Sealing – *Basement*s and *Crawl Spaces* – *Crawl Spaces* - Closed *Crawl Spaces*-Air Sealing Exterior Wall (SF)

3.1402.4 (a, b) Air Sealing – *Basement*s and *Crawl Spaces* – *Crawl Spaces* - Closed *Crawl Spaces*-Air Sealing Brick Curtain Walls with Piers (SF)

3.1402.5 (a,b) Air Sealing – *Basement*s and *Crawl Spaces* – *Crawl Spaces* - Closed *Crawl Spaces*-Attached *Crawl Spaces* Under *Unconditioned Space*s (SF)

3.1488 Special Considerations

3.1488.1 (a, b, c) Air Sealing – *Basement*s and *Crawl Spaces* – Special Considerations - Skirting Post and Pier Foundations (SF)

3.1488.2 (a,b,c,d,e,f,g,h,i,j) Air Sealing – *Basement*s and *Crawl Spaces* – Special Considerations - Skirting Manufactured Houses (MH)

Insulated Skirting Installation Requirements

If *Inaccessible Underbellies* or *Exposed Floors* are un-insulated and inaccessible, insulated skirting may be installed if it is determined in the Energy Audit to be cost-effective.

- The skirting must be metal, vinyl or *Pressure Treated* plywood supported by a wood frame and insulated with a minimum R-13 faced batt or a minimum R-10 foam board.
- The frame must have a *Pressure Treated*, redwood or cedar bottom plate and the vertical studs should be placed on a minimum 24 inch centers.
- Insulation must cover the top plate and extend a minimum of 24 inches on top of a ground laid moisture barrier.
- All seams and joints in the skirting must be caulked.
- The access must be constructed of ¾ inch *Pressure Treated* plywood, and be a minimum of 20 inches in width. It must be attached with 2 hinges and a latching mechanism. The access must be insulated with minimum R-13 batt or a minimum R-7 rigid insulation and weather-stripped with the last fastener or screw no more than 2-1/2 inches from the end of the weatherstrip.
- A manufactured insulating skirting kit may be used. The kit must be a minimum R-8 insulation and include 1 access.

3.1488.1 (a,b,c) Air Sealing – *Basement*s & *Crawl Spaces* – Special Considerations – Skirting Post and Pier Foundations (SF)

3.1488.2 (a,b,c,d,e,f,g,h,i,j) Air Sealing – *Basement*s & *Crawl Spaces* – Special Considerations – Skirting *Manufactured Homes* (MH)

3.16 Ducts

Sealing, repairing and insulating existing *accessible ductwork* provides Nebraska Weatherization Assistance Program (NeWAP) clients with energy cost reductions and improved comfort. Sealing leaky ducts also help to improve indoor air quality.

3.1601 Duct Preparation

Prior to sealing and/or insulating ducts NeWAP sub-grantees ***shall***:

- Inspect and evaluate the existing system to ensure that all ducts and plenums are properly fastened, supported and sealed to reduce air leakage.
  - **3.1601.1 (a,b,c,d,e,f,g,h,I,j) Ducts – Duct Preparation - Preparation and Mechanical Fastening (SF)**
  - **3.1601.2 (a,b) Ducts – Duct Preparation - Preparation for SPF Application (SF) (MH)**
  - **~~3.1601.3~~ (a) Ducts – Duct Preparation - Support (SF)**
  - **3.1601.4 (a) Ducts – Duct Preparation - Support for Horizontal, Suspended Ducts (MH)**
  - **3.1601.5 (a,b,c,d,e,f,g,h,i) Ducts – Duct Preparation - Preparation and Mechanical Fastening (MH)**
- Test ducts to determine the size and location of leaks.
- Consider sealing off supply and return registers in unoccupied *Basements* rooms

Prior to sealing and/or insulating ducts NeWAP sub-grantees ***must*** verify and make reasonable attempts to ensure that duct systems are providing balanced, adequate airflow to living spaces. When airflow is a problem sub-grantees ***must*** consider the following options:

- Cleaning the filter or replacing disposable filters.
- Repairing, realigning or replacing bent, damaged, missing or restricted floor registers.
- Realigning and appropriately secure disconnected duct work and floor registers.
  - **3.1602.4 (a,b,c,d) Ducts – Duct Sealing - Air Sealing System Components (SF)**
- Moving/installing filter racks into an area that is convenient and conducive for the client to access.
- Removing obstructions to registers and ducts.
- Eliminating kinks in flex duct and replacing collapsed ducts with metal duct.
- Installing new duct work or *Hydronic pipes* to balance the system and/or provide *conditioned* air throughout the building.
- Installing a transfer grille(s) to improve airflow in the building.
- Undercutting interior doors.

3.1602 Duct Sealing

Duct Sealing

- *Accessible Ducts* ***must*** be sealed before insulating.
- *Cross over ducts* must be inspected and weatherized.
- Seal leaky joints between supply and return registers and the floor, wall, and ceiling to which they are attached.
  - **3.1602.4 (a,b,c,d) Ducts – Duct Sealing - Air Sealing System Components (SF)**
  - **3.1602.12 (a,b,c) Ducts – Duct Sealing - Air Sealing System Components (MH)**
- Seal penetrations made by wires or pipes traveling through ducts.
- Use nontoxic and water-resistant mastic.
- Use mesh tape when openings and tears are over 1/8 of an inch.
  - **3.1602.1 (a,b,c) Ducts – Duct Sealing - Air Sealing Duct System (SF)**
- Use marked Energy Code compliant (UL181 A (rigid systems) or UL181 B (flex system)) duct sealing tape when the use of mastic is not feasible.

- Install pre-manufactured or site manufactured durable filter slot covers when existing covers are missing or damaged.

3.1602.2 (a) Ducts – Duct Sealing - Duct Spray Polyurethane Foam (SPF) Installation (SF) (MH)
3.1602.5 (a,b,c) Ducts – Duct Sealing - Return—Framed Platform (SF)
3.1602.7 (a,b) Ducts – Duct Sealing - Return and Supply Plenums in *Basements* and *Crawl Spaces* (SF)
3.1602.8 (a,b,c,d,e,f) Ducts – Duct Sealing - Supply Plenum (Furnace to Trunk Duct Connection) in Both Up-flow and Down-flow Air Handler Configurations (MH)
3.1602.9 (a,b,c,d,e,f,g,h) Ducts – Duct Sealing - *Crossover-Ducts* (MH)
3.1602.10 (a,b,c,d,e,f) Ducts – Duct Sealing - Hard and Flex Branch Ducts (MH)
3.1602.11 (a,b,c,d) Ducts – Duct Sealing - Air Sealing System (MH)

3.17 Additions

The following standards must be followed when NeWAP sub-grantees air sealing additions attached to manufactured housing:

3.1701.1 (a,b,c,d,e,f,g,h,I,j,k) Air Sealing – Additions – Attached Additions - Holes, Penetrations, and Connection Seam (MH)

4 INSULATION

Appropriate installation is required for insulation to provide energy savings and increase occupant comfort. The insulation ***must*** be installed:

- in conjunction with an effective air barrier.
- covering the entire area intended for insulation without voids or edge gaps.
- according to manufacturer's instructions, in the case of blown insulation, it should be installed at sufficient density to resist settling.
- observing lead-safe weatherization practices with all tasks that may disturb paint.

Fiberglass batt insulation installed in a *Living area* must be covered with paneling, plywood, chipboard, hardboard or drywall, with the exception of sill box insulation. If the installed covering is:

- drywall, it must be made paint ready.
- plywood, chipboard or hardboard is installed, the joints must be caulked.
- paneling is installed, it must be a minimum 3/16 inch and the joints must be caulked.

4.10 Attics

4.1001 General Preparation

Prior to installing attic insulation subgrantees ***must*** inspect for, prepare for and document the following issues/concerns:

Air Sealing

- Complete and document in the client file air-leakage (*pressure plane*) testing to verify that all attic planes in the home have been appropriately sealed to provide an effective air barrier that allows the attic insulation to be effective.

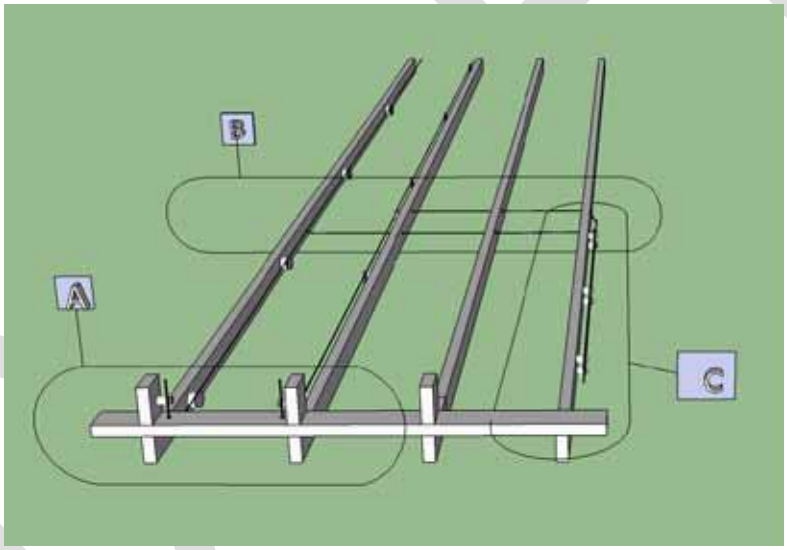
4.1001.6 (a,b,c,d) Insulation – Attics— General Preparation— Preparation for Spray Polyurethane Foam (SF)
4.1001.7 (a,b,c,d) Insulation – Attics— General Preparation— Preparation for SPF (SF)
4.9901.1 (a,b,c) Insulation – Additional Resources— General Information on Spray Polyurethane Foam (SPF) (SF) (MH)

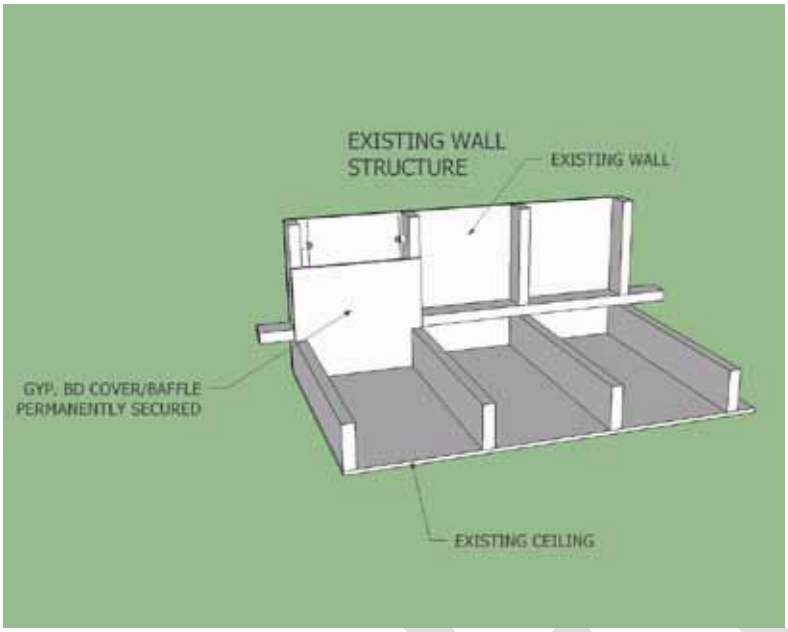
Knob & Tube Wiring

- Complete appropriate shielding procedures of any active Knob & Tube Wiring. The Nebraska State Electrical Board does not permit directly covering knob and tube wiring with insulation. Subgrantees *must* comply with the following fire and electrical safety procedures before insulating.

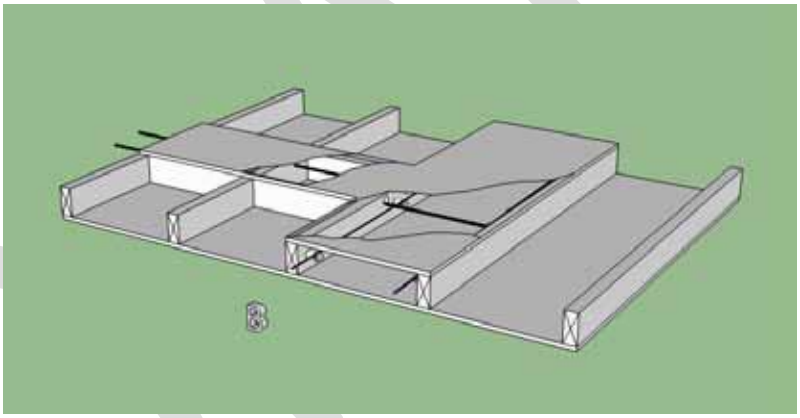
4.1001.2 (a,b,c) - Insulation – Attics— General Preparation— Knob and Tube Wiring (SF)

  - Inspect all attic areas for knob-and-tube wiring.
  - Attic areas with knob-and-tube wiring that are indicated as cost-effective for implementation on the Energy Audit *must* be insulated after the wiring has been appropriately covered to prevent direct contact with the insulation and to provide adequate air space (a minimum of 3 ½" clearance) for "cooling" of the wire. The costs associated with covering the knob and tube wiring should be included in the cost, the *SIR* calculation, and the invoicing of the Measure so that the costs associated with the shielding can be included as an Energy Efficiency Measure in the BCJO. In situations where the additional costs associated with shielding the knob-and-tube wiring impacts the *SIR*, making the Measure ineligible, those costs may also be invoiced as a Health and Safety cost. (See Details B & C below)
  - Appropriate shielding materials for concealing the knob-and-tube wiring *must* include gypsum board (5/8" or thicker), plywood or oriented strand board.

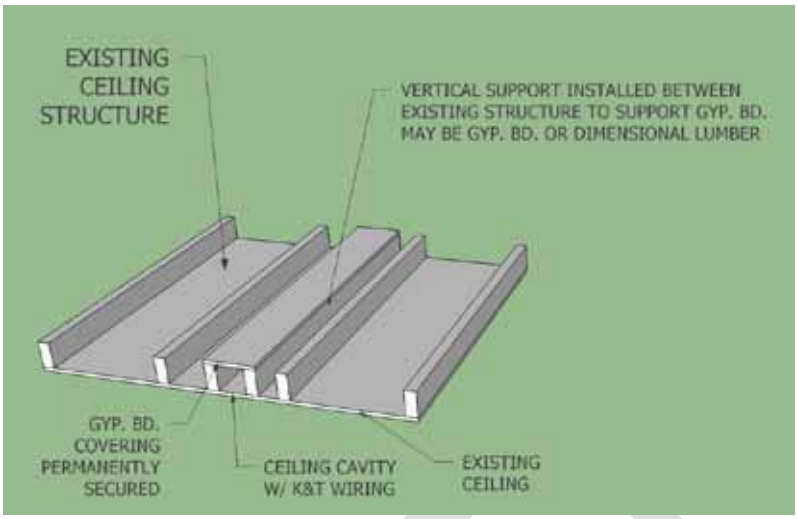




Detail A



Detail B



Detail C

- Attics where Knob-and-Tube Wiring has been previously covered with insulation and the Energy Audit indicates that it is cost-effective to install additional insulation, can be insulated when it has been determined where the wiring is located and that it is actually still "active". This determination may be completed by:
  - a licensed electrician
  - the use of a thermal imager/scanner
  - visually or physically locating the wires or
  - another verifiable option determined by the sub-grantee and approved by the Nebraska Energy Office

  Once the determination of the wire locations is documented in the client file, the wiring may be appropriately shielded as indicated above to prevent direct contact with the additional insulation and to provide adequate air movement space for cooling of the wire. Following appropriate shielding, insulation may be installed over the shielding.
- In attic areas where knob-and-tube wiring penetrates the plane of the attic and extends up into a side or *Kneewall*, a fire resistant baffling *must* be installed around the wire to provide sufficient space for air movement around the wire to provide adequate air space to accommodate the cooling of the wire. (See Detail A)
- If attic installation is being installed as per the directive above, the Nebraska State Electrical Board recommends the use of a licensed electrician for the installation of safety fuses as is indicated in the National Electrical Code.
- Existing fuses must remain intact if no insulation is being completed in the home.

Recessed Lighting

- Air seal existing recessed light fixtures by following manufacturer's instructions concerning clearance to combustibles for recessed light fixtures. If there are no instructions available, construct a box from fire code gypsum that is two foot square, two feet high and enclosed (notches may have to be cut to accommodate attic floor joists) and air seal the box.

4.1001.1 (a,b,c,d) Insulation – Attics— General Preparation— Non-Insulation Contact (IC) Recessed Light (SF)

Shielding, Damming and Junction Boxes

- When adding additional insulation to the attic, install shielding around heat and high-*Heat Sources*.

4.1001.3 (a,b,c,d) Insulation – Attics— General Preparation— Fireplace Chimney and Combustion Flue Vents (SF)

- In attics where no additional insulation will be installed, Sub-Grantees ***must*** install shielding around heat and high-*Heat Sources* with costs incurred being charged to Health and Safety.
  - Shielding must be kept a minimum of 3" from any *Heat Source* and a minimum of 6" from a *High Heat Source*.
  - Sheet metal shielding around heat producing devices or chimneys, must be fastened securely so the barrier won't collapse.
  - All shielding must be installed at a height to accommodate the depth of the added insulation.
- Install damming around attic accesses, exhaust fans, soffit vents and uninsulated attics adjacent to insulated attics.
  - All damming must be installed at a height to accommodate the depth of the added insulation.
  - Damming must be installed to ensure insulation will be full depth over all exterior top plates of the wall if possible.
- Install chutes, dams, tubes, or other blocking materials to prevent blown insulation from plugging air channels between soffit vents and the attic. These devices maximize the amount of insulation installed over top plates and help to prevent the wind-washing of insulation caused by cold air entering soffit vents.

4.1001.4 (a) Insulation – Attics— General Preparation— Venting Eave of Soffit Baffles (SF)

- All junction boxes must have approved covers, and their location must be marked with a flag or other visible marker.

4.1001.5 (a) Insulation – Attics— General Preparation— *Dense pack* Preparation (SF)

Attic Accesses and Hatch Standards

- Provide an access to all *accessible attics* over 100 square feet.
- Install new attic accesses in an area agreeable to the client and conducive to adding insulation.
- Install new attic accesses as per state and local codes.
- Install new attic hatch covers, as needed, on new and/or existing accesses.

4.1006.2 (a,b,c,d,e) Insulation – Attics— Attic Openings— Access Doors and Hatches (SF)

- New and existing attic accesses adjacent to *conditioned* areas must be weatherstripped and insulated with rigid insulation board to match the R-value of the adjacent ceiling surface and the insulation must fit snug to the damming boards. The insulation must be attached to the access door.
- Attic and attic access insulation must be installed to provide continuous insulation coverage. Batt insulation may need to overlap the opening.
- The access must be caulked with a paintable clear caulking or with a color complementary to the surface to which it is applied.
- The access must be finished to match the ceiling where installed as closely as possible.
- Attic accesses must be dammed with 1 inch common lumber or ¾ inch plywood fastened securely to the ceiling joists so the damming won't collapse or move.

- The new hatch must be properly framed and should have a minimum opening of 13 inches x 20 inches and boxed with 1 inch thick common lumber or ¾ inch plywood at a height to accommodate the added insulation.
- The hatch casing must be caulked with a paintable clear caulk or with a color complementary to the surface to which it is applied.
- The hatch cover must be constructed of ¾ inch plywood or particle board.
- If a walk-up attic access is present, the access must be weatherstripped and insulated with rigid insulation board to match the R-value of the adjacent ceiling surface and be hinged. Access insulation must be installed to provide continuous insulation coverage. Insulation may need to overlap the opening.
- If a pull-down ladder hatch is present it must be dammed with 1-inch common lumber or ¾ inch plywood with a hinged ¾ inch plywood lid, weatherstripped and insulated with rigid insulation board to match the R-value of the adjacent ceiling surface. Access insulation must be installed to provide continuous insulation coverage. Insulation may need to overlap the opening and cover the sides.
- Weatherstripping for all interior attic accesses must have the last fastener of the weatherstripping located within 2-1/2 inches from the end of the weatherstrip.

Special Considerations

- If a standpipe is installed, insulation may be installed over the exhaust fan. The standpipe must be attached with screws.

Worker and Client Safety

- Wear OSHA approved respirators or dust masks while blowing insulation or installing batts.

  2.0104.1 (a,c) Health & Safety – Safe Work Practices— Insulation— Insulation Worker Safety (SF) (MH)
- Inspect ceilings to ensure that the weight of the added insulation can be supported.
- Ensure that leaks in the roof and penetrations in the ceilings have been repaired prior to insulating the attic (utilizing incremental repair cost requirements). If roof leaks cannot be appropriately repaired, don't insulate the attic.

  2.0401.1 (a) Health & Safety – Moisture— Air Sealing— Air Sealing Moisture Problems (SF) (MH)

Ventilation/Attic Ventilation Installation Standards

- All fans ***must*** be checked for proper damper operation.
- All kitchen and bath fans ***must*** be vented to the exterior of the building.

  6.6005.1 (a,b,c,d,e) Ventilation – Exhaust – Appliance Exhaust Vents - Clothes Dryer (SF) (MH)

  6.6005.2 (a,b,c,d,e,f,g) Ventilation – Exhaust – Appliance Exhaust Vents - Kitchen Range (SF) (MH)
- Venting ***must not*** be installed on metal roofs.
- Attics with metal roofs that cannot be properly vented ***must not*** be insulated.

  4.1088.1 (a,b,c,d,e) Insulation – Attics— Special Considerations – Attic Ventilation (SF)

  4.1088.3 (a,b,c) Insulation – Attics— Special Considerations – Skylights (SF)
- Attics with no *Vapor retarder* must have a minimum of 1 square foot of net free vent area for every 150 square feet of attic area.

- Attics with a *Vapor retarder* must have a minimum of 1 square foot of net free vent area for every 300 square feet of attic area.
- In attics with over 300 square feet of attic area, vents must be located to provide the most adequate venting opportunity.
- Roof vents should not be installed over framing members. If vents must be installed over framing members, care must be taken to insure that the rafters are not cut. The roof vent opening is to be framed.
- Soffit vents must be installed with the fins facing towards the house with rust proof, pan-headed screws.
- Gable vents must be set in caulking and nailed or screwed in place using rust proof fasteners and be trimmed.
- Gable vents installed in siding without wood sheathing behind it must have the vent framed.
- Roof, turbine and ridge vents must be sealed with roofing tar and attached with large headed roofing nails.
- Roof vents must be centered within 2 feet of the ridge or peak of the roof.
- The shingles must overlap the top half of the roof vent flange. The bottom half of the vent's flange must be exposed on top of the shingles.
- Venting should be evenly spaced and should be divided evenly between high and low or intake and exhaust vents.
- Roof, turbine and ridge vents are considered to be high or exhaust vents, while soffit and gable vents are considered to be low or intake vents.
- Exhaust fans without operating *backdraft dampers* must be retrofitted with *backdraft dampers*, or the fan must be replaced.
- PVC, rigid metal, metal flexible or galvanized pipe must be used for venting.
- Exhaust fan vent pipes may be insulated to prevent condensation.
- Flexible plastic ducting must not be used to vent exhaust fans.
- Metal flexible duct used for exhaust fan ventilation must not extend more than 6 feet.

4.1003 Attic Ceilings

Installing attic insulation appropriately is critical to ensure energy cost savings and client comfort. Insulation should be installed according to manufactures installation standards. Generally, in the NeWAP, blown-in insulation is installed in attics because it provides a more continuous coverage and it has the capability of easily filling existing holes and insulation gaps. To avoid settling, the insulation must be installed based on manufacturer's specification, to a uniform depth and density for proper coverage. The following standards must be met by NeWAP sub-grantees installing attic insulation:

- Blown insulation specifications ***must*** be stapled near the attic access of each *accessible attic.*
- The insulation specifications ***must*** include the insulation brand name, thermal resistance chart, certification that the insulation conforms to federal specifications, the name of the company or agency that installed the insulation, the date the insulation was installed, the number of bags of insulation installed, the square footage installed and the R-value of the added insulation.
- Insulation ***must*** be installed to extend over the top of all exterior plates and be the full R-value.
- Cellulose insulation ***must*** be installed over existing batt insulation whenever possible.

4.1005.4 (a,b,c,d) Insulation – Attics— Attic Floors— Accessible Floors – Loose Fill Over Existing Insulation (SF)

- Insulation ***must*** be installed using the *Tube-fill method* to a minimum of 3.5 pounds per cubic foot in enclosed ceilings.
- Enclosed ceilings ***must*** be insulated to the full cavity depth.

4.1003.1 (a,b,c,d) Insulation – Attics— Attic Ceilings— Pitched/Vaulted/Cathedralized Ceilings – Loose Fill (SF)

4.1003.2 (a,b) Insulation – Attics— Attic Ceilings— Pitched/Vaulted/Cathedralized Ceilings – *Dense pack* Over (SF)

4.1003.3 (a,b,c) Insulation – Attics— Attic Ceilings— Unvented Flat Roof with Existing Insulation (SF)

4.1003.4 (a,b,c,d,e) Insulation – Attics— Attic Ceilings— Cape Cod Side Attic – *Dense pack* Installation (SF)

4.1003.8 (a,b,c,d,e,f,g) Insulation – Attics— Attic Ceilings— Installing Fiberglass Blown Insulation for Flat, Bowed, or Vaulted Ceiling (via Roof Side Lift) (MH)

4.1003.9 (a,b,c,d,e,f,g) Insulation – Attics— Attic Ceilings— Installing Fiberglass Blown Insulation for Flat, Bowed, or Vaulted Ceiling (via Exterior Access from Top of Roof) (MH)

4.1003.10 (a,b,c,d,e,f,g,h) Insulation – Attics— Attic Ceilings— Installing Fiberglass Blown Insulation for Flat, Bowed, or Vaulted Ceiling (via Interior Access Through the Ceiling) (MH)

4.1003.11 (a,b) Insulation – Attics— Attic Ceilings— Installing Fiberglass Insulation in Roof-Over Construction (MH)

4.1005.2 (a,b,c,d) Insulation – Attics— Attic Floors— Accessible Floors – Loose Fill Insulation (SF)

4.1005.6 (a,b,c) Insulation – Attics— Attic Floors— Enclosed Attic Storage Platform Floors – *Dense pack* Installation (SF)

- If additional batt insulation must be installed, the new batt ***must*** be unfaced and installed perpendicular to the existing batt insulation.

4.1005.1 (a,b,c) Insulation – Attics— Attic Floors— Accessible Floors – Batt Insulation

4.1005.3 (a,b,c,d,e) Insulation – Attics— Attic Floors— Accessible Floors – Batt Insulation Over Existing Insulation (SF)

- Spray Polyurethane Foam Insulation Standards

4.1003.5(a,b,c)- Insulation – Attics— Attic Ceilings— Unvented Roof Deck – Spray Polyurethane Foam Installation (SF)

4.1003.6 (a,b,c) Insulation – Attics— Attic Ceilings— Vented Roof Deck – Spray Polyurethane Foam Installation (SF)

4.1005.7 (a,b,c,d,e) Insulation – Attics— Attic Floors— Accessible Floors – Preparation and Installation of Spray Polyurethane Foam (SF)

- Special Consideration Installation Standards

4.1006.3 (a,b,c,d,e) Insulation – Attics— Attic Openings— Whole House Fan (SF)

4.1004 Knee Walls

Preparation and Installation Standards

In *Kneewall* attics or attics in one-and-a-half story homes Sub-Grantees ***shall***:

- Insulate both the attic-joist area and the *Kneewall* ***or*** insulate the entire sloped roof and attic end walls.

4.1004.1 (a,b) Insulation – Attics— Knee Walls— Preparation for *Dense packing* (SF)

4.1004.3 (a,b,c,d) Insulation – Attics— Knee Walls— Strapping for Existing Insulation (SF)

4.1004.4 (a,b,c,d) Insulation – Attics— Knee Walls— Knee Wall Without Framing (SF)

4.1004.5 (a,b,c) Insulation – Attics— Knee Walls— Knee Walls and Gable Ends – Preparation for and Installation of Spray Polyurethane Foam (SF)

- Insulate *Kneewall*s with either batt or blown insulation or *Spray-Applied Insulation*.
  - *Kneewall* insulation must be held in place with staples, twine, wire, hex netting or wire expanders and must be covered with an *air Infiltration barrier*.

4.1004.2 (a,b,c) Insulation – Attics— Knee Walls— Preparation for Batt Insulation (SF)

- Tightly pack the floor cavities at the base of the *Kneewall*s with batt, blown, rigid or *Spray-Applied Insulation*.
  - If batt insulation is used to seal the base of the *Kneewall*s, the batt must be sealed in an enclosed *Vapor barrier*.
  - Materials used must form an airtight seal.
  - If *Spray-Applied Insulation* is used, an *air Infiltration barrier* is not needed.
- Provide *accessible Kneewalls* with a minimum of one access.
  - Locate new access door(s) in an area agreeable to the client and conducive to the installation of the insulation.
  - Accesses adjacent to *conditioned* areas must be weatherstripped and insulated with R-13 batt or a minimum R-7 rigid insulation attached to the access door. The last fastener on the weatherstripping must be within 2-1/2 inches from the end of the weatherstrip.
  - The trim of the access must be caulked with clear caulking or caulking that is a color complementary to the surface to which it is applied.
  - New accesses must be properly framed and be a minimum of 13 inches wide and 20 inches in height.
  - New access covers or doors must be minimum ¾ inch plywood and attached with a minimum of 2 hinges and 2 latching mechanisms.
  - New accesses must be finished to match the wall as closely as possible.

4.1005 Attic Floors

- Accessible *Exposed Floors* that have an existing covering ***must*** be insulated with blown insulation installed at a minimum of 3.5 pounds per cubic foot. Entry holes must be plugged with wood or plastic plugs and sealed appropriately.

4.1005.5 (a,b,c,d) Insulation – Attic Floors— Enclosed Bonus Room Floor Over *Unconditioned Space – Dense pack* Installation (SF)

4.1006 Attic Openings

Walk-Up Stair Attic Insulation Preparation and Installation Standards

In attics with walk-up stairs and door Sub-Grantees ***shall***:

- Establish a continuous insulation and air barrier over the top of the stairwell ***or*** by sealing and insulating the walls of the stairwell and the angled plane of the stair treads/risers and weatherizing the stairwell door.

3.1002.1 (a,b,c,d,e,f) Air Sealing – Attic - Open Stairwells - Interior with Sloped Ceilings (SF)

3.1002.2 (a,b,c,d,e,f) Air Sealing – Attic - Open Stairwells - Stairwell to Attic – Door at Bottom with No Ceiling Above (SF)

3.1002.3 (a,b,c,d,e) Air Sealing – Attic - Open Stairwells - Stairwell to Attic – Door at Top with Finished Ceiling Above (SF)

Attics With Retractable Stairs - Insulation Preparation and Installation Standards

In attics with retractable stairways Sub-Grantees ***shall***:

- Build or purchase a cover that air seals the access and accommodates insulating.

4.1006.1 (a,b,c,d) Insulation – Attics— Attic Openings— Pull-Down Stairs (SF)

4.1088 Special Considerations

The following standards must be followed when NeWAP sub-grantees insulate attic areas that incorporate the following special construction considerations:

4.1088.1 (a,b,c,d,e) Insulation – Attics – Special Considerations — Attic Ventilation (SF)

4.1088.3 (a,b,c) Insulation – Attics – Special Considerations — Skylights (SF)

4.1088.6 (a,b,c,d,e,f,g,h) Insulation – Attics – Special Considerations — Installing Insulation at Flat and Cathedral Ceiling Transition Wall (MH)

4.11 Walls

4.1101 Preparation

Prior to installing wall insulation subgrantees must inspect for, repair and document the following issues/concerns:

- Evidence of moisture damage, if condition of the siding, sheathing, or interior wall finish indicates an existing moisture problem, no sidewall insulation should be installed until the moisture problem has been identified and corrected.
- Seal gaps in external window trim and other areas that may permit water into the wall.
- Ensure that the interior and exterior surfaces of the walls are capable of withstanding the force of insulation blowing.
- Complete minor surface repair on interior and exterior surfaces prior to insulating.

4.1101.1 (a,b) Insulation – Walls— Preparation – Exterior Wall *Dense pack*ing (SF)

4.1101.5 (a,b) Insulation – Walls— Preparation – Exterior Wall *Dense pack*ing (MH)

- Locate and seal interior openings from which insulation may escape, such as pocket doors, balloon framing, un-backed cabinets, interior soffits, and closets.
- Verify the exterior walls do not have active knob-and-tube wiring. Exterior walls that have active knob-and-tube wiring must not be insulated. Walls in additions on these homes that do not have active knob-and-tube wiring must be insulated if the Energy Audit of the home indicates the insulation is cost–effective for implementation. To ensure appropriate heating and cooling sizing calculations are completed by the program for the sizing of the mechanical equipment, the NEAT Audit of the home must include appropriate areas/size calculations of the active knob-and-tube walls with NONE selected as the “added insulation” option in the program.

4.1102 Accessible Walls

In homes with accessible, open wall cavities Sub-Grantees ***shall***:

- Insulate with batt, blown or *Spray-Applied Insulation* and cover the cavity.
  - If the covering of an open wall cavity is drywall, the drywall must be taped with one coat of drywall mud applied.

- If the covering of an open wall cavity is plywood, chipboard or hardboard the joints must be caulked.
- Fill the entire cavity.
- If faced batt insulation is installed in an open wall cavity, the *Vapor barrier* must be installed to the warm side and fit snugly between the studs and wall.
- Cut the batt insulation to the exact length of the cavity.
- Install the insulation around wiring, piping, etc. by splitting the batt, not by compression.
- Removal of siding containing Asbestos must comply with federal, state and local regulations.

4.1102.1 (a,b,c,d) Insulation – Walls— Accessible Walls – Open Wall Insulation – General (SF)

4.1102.2 (a,b,c,d) Insulation – Walls— Accessible Walls – Open Wall Insulation – Spray Polyurethane Foam (SPF) (SF)

4.1103 Enclosed Walls

Exterior, Exterior Wall Insulation Installation Standards

Appropriate installation of wall insulation is essential to ensuring energy cost savings and client comfort. Insulation should be installed according to manufactures installation standards. In homes where exterior wall cavities are being blown Sub-Grantees shall:

- Remove or drill siding and fill all enclosed wall cavities. Wall cavities that are less than 3 feet in height or where it is not possible to tube fill, may be insulated through a minimum 1 inch entry holes.
- Slate siding that may contain asbestos may be removed as long as the siding material does not become friable.
- Metal or vinyl siding may be removed with the aid of a zip tool.
  - Removed siding must be reinstalled using the original fastening system whenever possible. The seam tabs on slate siding must be reinstalled.
  - The entry holes must be sealed with plastic or wood plugs, or covered with felt paper prior to reinstalling the siding if the siding was removed.
  - Seal and plug holes before replacing siding.
- In homes insulated from the inside, holes will be plugged and taped or sealed with an appropriate material and made ready for paint.
- Asbestos shingled siding may be carefully removed by pulling the nails holding them to the sheathing or else nipping off the nail heads. Dampening the tiles helps to keep dust down. Refer to your company policy and procedures when working with asbestos materials.
- Probe all wall cavities through holes, as they are drilled, to identify fire blocking, diagonal bracing, and other obstacles. After probing, drill whatever additional holes are necessary to ensure complete coverage.
- Insulate stucco walls through either interior or exterior access.
  - Entry holes in stucco or masonry siding must be sealed with mortar or a material specifically manufactured to repair stucco or masonry.
  - Interior entry holes must be made ready for paint.
  - Interior entry holes in drywall or plaster must be plugged and taped or sealed with a material specifically manufactured to repair drywall or plaster.
- Document in the client file back-plastered (two layer) walls that are too difficult to insulate properly.
- Verify and document in the client file the need to practice lead-safe weatherization

procedures.

- Drill 2-to-3-inch diameter holes to access stud cavity.
- To prevent settling, cellulose insulation must be installed using the *Tube-fill method* to a minimum density of 3.5 pounds per cubic foot.
- *Dense*-pack wall insulation is best installed using a blower equipped with separate controls for air and material feed.
- Wall repairs must be durable and permanent and match the existing area as closely as possible.
- Materials used in areas of high moisture or areas exposed to the weather must be of suitable grade.
- Whenever plastic or wood plugs are used on the exterior of the siding, the plugs must be painted to match the existing siding color.
- All sealing material must completely seal the opening and be textured and painted to match the surrounding surface.
- Seal floor cavities in balloon framed walls by installing insulation plugs (i.e. plastic bags filled with insulation or rigid insulation/air blocks)

4.1103.1 (a,b) Insulation – Walls— Enclosed Walls – *Dense pack* Exterior Walls (SF)

4.1103.2 (a,b,c,d,e,f) Insulation – Walls— Enclosed Walls – Additional Exterior Wall Cavities (SF)

4.1104 Manufactured Housing Walls

Exterior, Exterior Wall Insulation Installation Standards

Appropriate installation of wall insulation is essential to ensuring energy cost savings and client comfort. Insulation should be installed according to manufactures installation standards and the following standards:

4.1104.1 (a,b,c,d,e,f,g) Insulation – Walls – Manufactured Housing Wall Insulation - Stuffing Wall Cavities with Fiberglass Batts (MH)

4.1104.2 (a,b,c,d,e,f,g) Insulation – Walls – Manufactured Housing Wall Insulation - Fiberglass Blown Insulation Installation (Lifting Siding) (MH)

4.1104.3 (a,b,c,d,e,f,g) Insulation – Walls – Manufactured Housing Wall Insulation - Fiberglass Blown Insulation Installation (via Penetrations through or Behind the Siding) (MH)

4.1104.4 (a,b,c,d,e) Insulation – Walls – Manufactured Housing Wall Insulation - Spray Foam Insulation Installation in Cavities above Doors and Windows (MH)

4.13 Floors

Preparation and Inspection Requirements

In homes where a floor serves as an air/thermal boundary, prior to installing floor insulation subgrantees ***must*** inspect for, prepare for and document the following issues/concerns:

- Sealing of stud cavities if the walls are balloon framed prior to insulating floors.
- Inspection of ceilings of garages to ensure that the weight of the added insulation can be supported.

4.1301 Accessible Floors

Floor Insulation Installation Standards

- Batt insulation ***must*** be appropriately cut to reduce voids and gaps in the insulation.

4.1301.1 (a,b,c,d) Insulation – Floors— Accessible Floors – Standard Floor System – Batt

Insulation (SF)

4.1301.3 (a,b,c,d.e) Insulation – Floors— Accessible Floors – Pier Construction Subfloor Insulation Batt Insulation with Rigid Barrier (SF)

4.1301.5 (a,b,c,d.e) Insulation – Floors— Accessible Floors – Standard Floor System – Cantilevered Floor—Batt Installation (SF)

- Floor insulation ***must*** be installed to fit tightly to the subfloor and securely fastened to ensure the contact is maintained.

  4.1301.2 (a,b,c,d) Insulation – Floors— Accessible Floors – Standard Floor System – Loose Fill with Netting (SF)

  4.1301.3 (a,b,c,d) Insulation – Floors— Accessible Floors – Standard Floor System – Loose Fill with Rigid Barrier (SF)

  4.1301.4 (a,b,c,d) Insulation – Floors— Accessible Floors – *Dense pack* Floor System with Rigid Barrier SF

- *Exposed Floors*, except over garages, ***must*** be insulated and covered with exterior grade plywood or tar impregnated fiberboard. All seams must be caulked.

  4.1301.3 (a,b,c,d) Insulation – Floors— Accessible Floors – Standard Floor System – Loose Fill with Rigid Barrier (SF)

  4.1301.4 (a,b,c,d) Insulation – Floors— Accessible Floors – *Dense pack* Floor System with Rigid Barrier SF

- *Exposed Floors* over garages ***must*** be insulated and covered with fire code drywall as per state and/or local code. The drywall ***must*** be taped and receive one coat of joint compound or the joints and seams must be caulked to form an airtight seal.

- Accessible *Exposed Floors* that have an existing covering ***must*** be insulated with blown insulation installed at a minimum of 3.5 pounds per cubic foot. Entry holes must be sealed with wood or plastic plugs.

  4.1005.5 (a,b,c,d) Insulation – Attic Floors— Enclosed Bonus Room Floor Over *Unconditioned Space* – *Dense pack* Installation (SF)

  4.1301.5 (a,b,c,d,e) Insulation – Floors— Accessible Floors – Cantilevered Floor – Batt Installation (SF)

  4.1301.6 (a,b,c,d,e) Insulation – Floors— Accessible Floors – Pier Construction Subfloor Insulation – Batt Insulation with Rigid Barrier (SF)

  4.1301.7 (a,b,c,d) Insulation – Floors— Accessible Floors – Pier Construction Subfloor Insulation – Loose Fill with Rigid Barrier (SF)

  4.1301.8 (a,b,c,d) Insulation – Floors— Accessible Floors – Pier Construction Subfloor Insulation – *Dense pack* with Rigid Barrier (SF)

  4.1301.9 (a,b,c,d) Insulation – Floors— Accessible Floors – Open Floors Over *Unconditioned Space* and Cantilevered Floors, Floors Over Garages, Floors Over *Unconditioned Crawl Spaces* – Spray Polyurethane (SF)

4.1303 Manufactured Housing Floor Cavity Insulation Preparation and Inspection Requirements

In *Manufactured Homes* where a floor serves as an air/thermal boundary, prior to installing floor insulation subgrantees ***must*** complete an inspection of the floor assembly and document any issues/concerns found.

4.1302.1 (a,b) Insulation – Floors— Manufactured Housing Belly Preparation – Prepare Belly Floor Cavity for Insulation (MH)

4.1303.1 (a,b,c,d,e) Insulation – Floors— Manufactured Housing Floor Cavity Preparation – Insulation of Floor Cavity with Blown Material (MH)

4.1303.2 (a,b,c,d,e) Insulation – Floors— Manufactured Housing Floor Cavity Preparation – Insulation of Floor Cavity with Batt Materials (MH)

4.1303.3 (a,b,c,d,e,f,g) Insulation – Floors— Manufactured Housing Floor Cavity Preparation – Insulation of Floor Cavity with Spray Foam Material (MH)

4.14 *Basement*s and *Crawl Spaces*

4.1401 Band/Rim Joists

Preparation Requirements

Prior to installing rim joist insulation subgrantees ***must*** inspect for, prepare for and document the following issues/concerns:

- Sealing of floor cavities in balloon framed walls by installing insulation plugs (i.e. plastic bags filled with insulation or rigid insulation/air blocks).
- Sealing of all penetrations in the rim prior to installing insulation.
- Rim sealing insulation products that are reimbursable through the NeWAP include:
  - two-part spray foams or
  - Polystyrene or polyurethane rigid insulation board sealed on all edges.

Insulation Installation Requirements

- Rim joist insulation ***must*** be installed in all accessible cavities with a depth of 2 inches or more.

4.1401.1 (a,b,c,d) Insulation – *Basements* & *Crawl Spaces* — Band/Rim Joists – Spray Polyurethane Foam (SPF) (SF)

4.1401.2 (a,b,c) Insulation – *Basements* & *Crawl Spaces* — Band/Rim Joists – Insulation other than Spray Polyurethane Foam (SF)

- Rim Joist insulation ***must*** be a minimum R-10.

4.1402 *Basement*s and *Crawl Space* Walls

Insulating *accessible foundations* and sealing the thermal boundary(s) in the lower levels of buildings, can provide significant comfort and energy savings. Sealing at the lower level helps to reduce *Stack Effects* that can impact ductwork leakage in lower levels and indoor air quality.

Preparation and Air Sealing Requirements

Prior to installing foundation insulation subgrantees ***must*** inspect for, prepare for and document the following issues/concerns:

- The location of walls between an *Unconditioned Crawl Space* and *conditioned Basement* areas must be weatherized.
- Appropriated accessibility to Crawlspaces /*accessible foundation*:
  - Accesses ***must*** be installed in all accessible crawlspaces.
  - A minimum of one access ***must*** be installed.
  - New *Crawl Space* accesses ***must*** be located in an area agreeable to the client and conducive

to insulating.
    - New access cover and/or hardware ***must*** be installed if necessary.
- Appropriate air sealing and insulation of exterior accesses to crawlspaces:
    - Existing exterior accesses ***must*** be weatherstripped and insulated with minimum R-11 batt or a minimum R-7 rigid insulation. The last fastener of the weatherstripping must be located within 2-1/2 inches from the end of the weatherstrip.
    - Hardware may be added if necessary.
    - Accesses adjacent to *conditioned* areas where the common walls are treated ***must*** be weatherstripped and insulated. The last fastener of the weatherstripping must be located within 2-1/2 inches from the end of the weatherstrip.
    - New exterior accesses ***must*** be constructed of ¾ inch *Pressure Treated* plywood, be a minimum of 20 inches in width, be attached with 2 hinges and a latching mechanism and be weatherstripped and insulated with minimum R-11 batt or a minimum R-7 rigid insulation. The last fastener of the weatherstripping must be located within 2-1/2 inches from the end of the weatherstrip.
- Existing accesses that do not provide 16" x 24" (thru crawlspace wall) and 18" x 24" (thru floors) access ***must*** be reframed to provide a minimum opening of 20 inches to accommodate the insulation and access.

4.1402.5 (a,b) Insulation – *Basements* & *Crawl Spaces* — Band/Rim Joists – Spray Polyurethane Foam (SPF) (SF)

- Any new framing ***must*** be *Pressure Treated*, redwood or cedar.
- New floor accesses ***must*** be properly supported.

General Foundation Insulation Installation Requirements

- Foundation wall insulation products that are reimbursable through the NeWAP include:
    - two-part spray foams,
    - polystyrene or polyurethane rigid insulation board sealed on all edges, or
    - draped batt insulation sealed appropriately, in limited cases when no moisture threats are present.
- Foundation insulation in *Basements* ***must*** be installed as per local and state Code requirements.
- Installed insulation must have no significant voids or edge gaps.

***Basement* Wall Installation Requirements**

- If batt insulation is used the wall must be framed to adequately support the insulation.
- If foam board is used the insulation must be attached to the foundation wall with construction adhesive or masonry nails or a combination of the two.
- Insulation must be covered as required by local or state code jurisdiction requirements.
- *Basement* wall insulating systems must be installed according to manufacturer's instructions and be a minimum R-10.

4.1402.2 (a,b,c) Insulation – *Basements* & *Crawl Space* Walls – *Basement* Wall Insulation – No Groundwater Leakage (SF) (MH)

***Crawl Space* and *Ledged Basement* Walls Installation Requirements**

- Crawlspace and *Ledged Basement* wall must be insulated with faced batt foam board or *Spray-Applied Insulation*.
- The insulation must fill the sill box, extend down the foundation wall and lay a minimum of 24

inches on top of a ground laid moisture barrier.

- To ensure there are no gaps in the wall insulation, standard 24 inch wide batts must be used in areas of 16 inch floor joist spacing and standard 16 inch batts must be used in areas of 24 inch joist spacing.
- If faced batt insulation is installed, the *Vapor barrier* must be to the warm side.

4.1402.1 (a,b,c,d,e,f,g) Insulation – *Basements* & *Crawl Space* Walls – Closed *Crawl Spaces* – Wall Insulation (SF)

4.16 Ducts

Sealing, repairing and insulating existing *accessible duct* work provides Nebraska Weatherization Assistance Program (NeWAP) clients with energy cost reductions and improved comfort. Sealing leaky ducts also help to improve indoor air quality.

Prior to sealing and/or insulating ducts NeWAP sub-grantees ***shall***:

- Inspect and evaluate the existing system to ensure that all ducts and plenums are properly fastened, supported and sealed to reduce air leakage.
  - **3.1601.1 (a,b,c,d,e,f,g,h,I,j) Ducts – Duct Preparation - Preparation and Mechanical Fastening (SF)**
  - **3.1601.2 (a,b) Ducts – Duct Preparation - Preparation for SPF Application (SF) (MH)**
  - **3.1601.3 (a) Ducts – Duct Preparation - Support (SF)**
  - **3.1601.4 (a) Ducts – Duct Preparation - Support for Horizontal, Suspended Ducts (MH)**
  - **3.1601.5 (a,b,c,d,e,f,g,h,i) Ducts – Duct Preparation - Preparation and Mechanical Fastening (MH)**
- Test ducts to determine the size and location of leaks.
- Consider sealing supply and return registers in unoccupied *Basements*/rooms.

Prior to sealing and/or insulating ducts NeWAP sub-grantees ***must*** verify and make reasonable attempts to ensure that duct systems are providing balanced, adequate airflow to living spaces. When airflow is a problem sub-grantees ***must*** consider the following options:

- Cleaning the filter or replacing disposable filters.
- Repairing, realigning or replacing damaged, missing or restricted floor registers.
- Realigning and securing disconnected duct work.
- Moving/installing filter racks into an area that is convenient and conducive for the customer to access.
- Removing obstructions to registers and ducts.
- Eliminating kinks in existing flex duct and replacing collapsed ducts with metal duct.
- Installing new duct work or *Hydronic pipes* to balance the system and/or provide conditioned air throughout the building.
- Installing a transfer grille(s) to improve airflow in the building.
- *Under-cutting* interior doors.

4.1601 Insulating Ducts

Duct Insulation

- Insulate supply ducts that run outside the thermal boundary with a minimum of R-8 vinyl, foil faced insulation or two part foam insulation.
- Do not insulate ducts that run through *Conditioned Space* unless they cause overheating in winter or condensation in summer.
- Seal the duct work before insulating.
- Cover all exposed supply ducts, leaving no areas of uninsulated duct.

- Fasten the insulation by mechanical means such as plastic straps, cord, wire, plastic or nylon bands.
- Use only tape, specifically manufactured for covering and securing joints.
- Install *Vapor barriers* the exterior sealing the joints with duct sealing tape, caulking or mastic.

4.1601.2 (a,b,c,d) Ducts – Insulating Ducts - Insulating Metal Ducts (SF)
4.1601.3 (a,b,c) Ducts – Insulating Ducts - Insulation and *Vapor barrier* (MH)
4.1601.5 (a,b,c,d,e) Ducts – Insulating Ducts - Insulating Metal Ducts (MH)

5 HEATING AND COOLING

5.30 Forced Air

5.3001 Design and Replacement

***Heating System* Replacement Requirements**

The following standards must be followed when furnaces are replaced/installed through the Nebraska Weatherization Assistance Program:

- Eligible unsafe *Heating Plants* in single family and *Manufactured Homes* that cannot be repaired, as determined by a *Qualified Heating Technician or*, *Certified Weatherization Staff* must be replaced.
- If a *Qualified Heating Technician* determines that a unit must be replaced, the unit must receive a second inspection by *Certified Weatherization Staff,* a second *Qualified Heating Technician* or gas utility company.
- Units that contain *Heating Plants* that are *inoperable* or red-tagged at the time of the initial inspection must not be weatherized until the *Heating Plant* has been repaired or replaced.
- With Nebraska Energy Office approval, multiple *Heating Plants* or motorized dampers may be installed to provide zone heating.
- Unsafe space heaters may be replaced with a forced air system.
- With Nebraska Energy Office approval, the *Heating Plant* may utilize a new fuel source.
- *Unvented Combustion Space Heaters* are not an eligible *Heating System* and must not be replaced with new *Unvented Combustion Space Heaters*.
- Existing *Unvented Combustion Space Heaters* may remain as secondary *Heat Sources*.

Replacement *Heating System* General Requirements

- All locations where equipment is to be installed or replaced must be appropriately prepared for the installation of the new equipment.

5.3002.1 (a,b,c,d,e) Heating & Cooling – Forced Air – Site Preparation – Preparation for New Equipment (SF)

- Forced air furnaces must have a minimum AFUE of 90 percent, boilers a minimum of 85 percent and wall and console heaters, a minimum of 80 percent.
- Efficiency ratings for forced air furnaces and boilers must be listed in the most current edition of the Gas Appliance Manufacturers Association (GAMA) Consumer's Directory of Certified Efficiency Ratings for Residential Heating and Water Heating Equipment.
- Heat exchangers in all replacement *Heating Plants* must have a minimum 10 year manufacturer's warranty and a minimum 1-year warranty for materials, workmanship, and serviceability..

2.0702.1 (a,b,c) Health and Safety – Occupant Education and Access – Installed Equipment - Warranty and Service Agreement (SF)

- The replacement *Heating Plant* must be competitively bid and properly sized using the post-weatherization characteristics of the home.

5.3001.1 (a.b.c.) Heating & Cooling – Forced Air - Design – Load Calculation and Equipment Selection (SF)

- A service label must be placed on or near the *Heating Plant* containing the name, business address and phone number of the company or agency performing the work, any repairs that were completed and the date the work was performed.
- Unvented gas and liquid-fueled space heaters that remain in a completed single-family house after weatherization must not have an input rating in excess of 40,000 Btu/hour and must not be located in, or obtain combustion air from sleeping rooms or storage closets.
- Air conditioner evaporator coils of operable air conditioning units must be replaced if they will not fit the new *Heating Plant.*
- Drip pans in poor condition may be replaced.
- Heat rise (supply temperature minus return temperature) must be within manufacturer's specifications.
- High limit should stop fuel flow within 10% of 200° F. Furnace must not cycle on high limit.
- Fan control should be set to activate fan at 130° to 140° F and deactivate it at 95° to 105° F. Slightly higher settings are acceptable if these recommended settings cause a comfort complaint.
- Static pressure, measured in both supply and return plenums should be within manufacturer's specifications.
- Blower should not be set to operate continuously.
- Seal holes through the jacket of the air handler with mastic or foil tape.
- Check clearances of heating unit and its vent connector to nearby combustibles, according to the International Fuel Gas Code (IFGC).
- Clock gas meter to insure correct gas input.
- Test gas water heater to insure that it vents properly after installation of a sealed-combustion, 90+ AFUE furnace. Install a chimney liner if necessary.
- Ensure proper sediment trap on gas line. (dirt leg)

Replacement *Heating System* Venting, Piping and Ducting General Requirements

- The replacement *Heating Plant* must use the existing *Distribution System*.
- New ductwork or *Hydronic pipes* may be installed to properly balance the system.

5.3001.2 (a,b,c,)Heating & Cooling – Forced Air - Design – Ductwork and Termination Design (SF)

- *Hydronic pipes* must be insulated with 1 inch material having a minimum R-4 pipe insulation specifically manufactured as *hydronic pipe* insulation. Joints and elbows must be insulated.
- Flexible ductwork must be no more than 4 lineal feet per run if possible.
- The replacement *Heating Plant* must be properly vented and use outside air for combustion if the unit will accept dedicated combustion air.
- If the replacement *Heating Plant* is installed with existing central air conditioning, the air conditioner evaporator coil should be a cased coil or be raised and made accessible for periodic service and cleaning.
- The condensate line must not be drained to the exterior of the home but to a code approved drain.
- If a new forced-air furnace or boiler is installed that will not be vented through the masonry chimney but the water heater will still be vented through that chimney, a properly sized flue liner must be installed.
- As an alternative, a power vent may be installed on the water heater.
- Furnace filter racks on new *Heating System*s must be installed in an area that is convenient and

conducive for the customer to access. The replacement *Heating Plant* must be properly vented. If the new *Heating Plant* will not be vented through the masonry chimney, but the water heater will still be vented through that chimney, a properly sized flue liner must be installed. As an alternative, a power vent may be installed on the water heater.

- In some instances with prior Nebraska Energy Office approval the installer may add return ducts or supply ducts as part of furnace replacement to improve air distribution, to eliminate duct-induced house pressures, and to establish acceptable values for static pressure and heat rise.
- Supply and return plenums must be mechanically fastened with screws and sealed to air handler with mastic and fabric mesh tape to form an essentially airtight connection on all sides of these important joints.
- All ducts must be sealed.
- Filters should be held firmly in place and provide complete coverage of blower intake or return register. Filters should be easy to replace. (filter racks are to be installed not just a hole cut in the return duct)

Cooling System Replacements Requirements

Cooling system replacements completed through the NeWAP ***must*** be shown as cost-effective through the home's Energy Audit, with appropriate documentation included in the client file, and ***must not*** be charged to the health and safety line item. The following standards ***must*** be followed for air conditioner or heat pump replacements to be reimbursed as eligible expenditures:

- Replacement central air conditioners ***must*** be a minimum 14-SEER (Seasonal Energy Efficiency Factor).
- Replacement heat pumps ***must*** be a minimum 14-SEER and 8.2HSPF (Heating Seasonal Performance Factor). Heat pumps must be installed with ramp-up type thermostats designed to bring backup heat in stages, and only when the heat pump can no longer keep up with demand, and must be able to differentiate between a demand call and a 'return from setback' call for heat.
- The replacement central air conditioner or heat pump ***must*** be properly sized using the post weatherization characteristics of the home with system sizing documentation included in the client file.

  5.3001.1 (a,b,c) Heating & Cooling – Forced Air - Design – Load Calculation and Equipment Selection (SF)
- Replacement central air conditioners and heat pumps ***must*** be replaced by a *Qualified Heating Technician*.
- A service label ***must*** be placed on or near the furnace plenum containing the name, business address and phone number of the company performing the work, any repairs that were completed and the date the work was performed.

Ductwork Replacement Requirements

New ductwork installed through the NeWAP ***must*** meet the following requirements:

- Flexible duct work ***must*** be no more than 4 lineal feet per run, if possible with appropriate documentation included in the client file.
- New ducts ***must not*** be installed in *Unconditioned Space*s unless absolutely necessary with appropriate justification located in the client file.
- New ducts, excluding jump ducts, ***must*** be physically connected to the existing *Distribution System* or to the furnace.

  5.3001.2 (a,b,c) Heating and Cooling – Forced Air – Design – Ductwork and Termination Design (SF)
  5.3001.3 (a,b,c,d,e) Heating and Cooling – Forced Air – Design – Replace Return Air Systems that

Incorporate Floor Cavity (Belly) and/or Attic as the Return Air Pathway (MH)

Replacement *Heating System* Thermostat General Requirements

- *Programmable Thermostat/Setback Thermostat*s may be installed.
- Mercury thermostats may be replaced with digital thermostats.
- New thermostats must be calibrated and adjusted and any operable accessories that were installed on the existing *Heating System* must be removed and reinstalled on the new *Heating System*, if possible. If a new thermostat is installed, the wire hole in the wall behind the thermostat must be sealed.
- Mercury thermostats must be properly disposed.

5.3003.9 (a,b,c,d,e,f,g,h,i,j,k,l,m)) Heating & Cooling – Forced Air – System Assessment & Maintenance – Heating and Cooling Controls (SF)

5.3003.11 (a,b,c,d,e,r,g,h,l,j,k,l,m,n,o) Heating & Cooling – Forced Air – System Assessment & Maintenance – Heating and Cooling Controls (MH)

5.3003 System Assessment/Inspection and Maintenance

Heating System Assessment/Inspection Requirements

Prior to weatherizing the *building envelope*, all *Eligible Heating Plants* over two (2) years of age that have not received a *Safety Inspection* during the twelve (12) months prior to the initial Weatherization inspection must be inspected by a *Qualified Heating Technician*, utility company or *certified weatherization staff*. During testing, make appropriate efforts to repair and adjust the existing furnace or boiler, before deciding to replace it. Replacement parts like gas valves and controls for older heating units are commonly available.

- If the *Safety Inspection* was performed by a *Qualified Heating Technician*, the need for replacement must be confirmed by a utility company, a second *Qualified Heating Technician* or *certified weatherization staff*.
- The *building envelope* must not be weatherized if the owner or client refuses a *Safety Inspection* of the *Heating System* or until any *Heating System* deficiency has been repaired and/or the *Heating Plant* replaced.
- Combustion (CAZ) safety testing is required when combustion *Heating System*s are present.
- Inspect venting of combustion *Heating System*s and confirm adequate clearances.
- The State of Nebraska's annual heating degree day normal, over the thirty year period from 1971-2000 is 6525, with January Mean °F temperatures that range from 23.2 in the warmest areas of the state to 22.8 in the coldest areas. Clients in units that contain *Heating Plant*s that are inoperable or red-tagged are in danger of frost bite, hypothermia and other life threatening issues. Therefore units that contain *Heating Plant*s that are inoperable or red-tagged at the time of the initial inspection must not be weatherized until the *Heating Plant* has been repaired or replaced.
- *Eligible Heating Plants* that cannot be repaired must be replaced.
- If a dwelling is heated by *Unvented Combustion Space Heaters* and an inoperable conventional *Heating System* is present, the conventional *Heating System* must be repaired or replaced to eliminate the need for unvented space heaters. If the need for *Unvented Combustion Space Heaters* cannot be eliminated, the sub-grantee must instruct the client regarding the dangers of carbon monoxide and excessive moisture levels, particularly if any *unvented space heaters* are left in the dwelling as a secondary *Heat Source*, or emergency back-up.
- If a dwelling utilizes *Unvented Combustion Space Heaters* as the primary *Heat Source* over 40,000

BTU, the *Unvented Combustion Space Heaters* must be replaced with a vented combustion *Heating System*.

***Safety Inspection* Requirements**

The *Safety Inspection* must include all of the following that apply to the *Heating System* being inspected:

- Conduct a fuel leakage test of the appliance piping and control system downstream of the meter to the appliance. Natural gas and propane piping systems may leak at their joints and valves. An electronic combustible gas detector (gas sniffer) will find all significant gas leaks if used carefully. Remember that natural gas rises from a leak and propane falls, so position the sensor accordingly.

  5.3003.15 (a,b,c,d,e,f,g,h,I,j) Heating and Cooling – Forced Air - System Maintenance - Combustion Analysis of Oil-Fired Appliances (MH)

  - Sniff all valves and joints with the gas sniffer.

    2.0105.1 (a,b,c) Health and Safety – Safe Work Practices– Heating & Cooling Equipment – Combustion Worker Safety (SF)

  - Accurately locate leaks using a non-corrosive bubbling liquid, designed for finding gas leaks.
  - All gas leaks should be repaired. If gas leak is detected have occupant notify the fuel supplier or a qualified technician.

    2.0105.1 (a,b,c) Health and Safety – Safe Work Practices– Heating & Cooling Equipment – Combustion Worker Safety (SF)

    2.0105.3 (a) Health and Safety – Safe Work Practices– Heating & Cooling Equipment – Combustion Worker Safety (MH)

- Visually inspect the venting system for proper size and horizontal pitch and determine that there is not blockage, vent size reduction or restriction, leakage, corrosion or other deficiencies that could cause an unsafe condition.
- Inspect burners and crossovers for blockage and corrosion.
- Determine that the pilot is burning properly and that main burner ignition is satisfactory.
- Test the pilot safety device to determine that it is operating properly.
- Visually determine that main burner gas is burning properly.
- If the appliance is equipped with a high and low flame control or flame modulator, check for proper main burner operation at low flame.
- Test for spillage at the draft hood relief opening.
- On furnaces and console heaters, test the heat exchanger for cracks and openings and visually inspect the heat exchanger for excessive corrosion.
  - Look for rust at exhaust ports and vent connector.
  - Look for flame impingement on the heat exchanger during firing.
  - Observe flame movement, change in chimney draft, or change in CO reading as blower is turned on and off.
  - Look for flame-damaged areas near the burner flame.
  - Measure the flue-gas oxygen concentration before the blower starts and just after it has started. There should be no more than a 1% change in the oxygen concentration.
  - Examine the heat exchanger, shining a bright light on one side and looking for light traces on the other using a mirror to peer into tight locations.
- On furnaces and console heaters, check the fan control for proper operation.

  5.3003.9 (a,b,c,d,e,f,g,h,I,j,k,m,n) Heating & Cooling – Forced Air – System Assessment & Maintenance – Heating and Cooling Controls (SF)

- Test and confirm the furnace efficiency operating standards.
  - Check heat rise after 5 minutes of operation. Refer to manufacturer's nameplate for acceptable

heat rise (supply temperature minus return temperature).
  - The fan-off temperature should be between 90° and 95° F, with the lower end of the scale being preferable for maximum efficiency.
  - The fan-on temperature should be less than 120° F.
  - The high-limit controller should shut the burner off before the furnace temperature reaches 250°F.
  - On time-activated fan controls, verify that the fan is switched on within two minutes of burner ignition and is switched off within 2.5 minutes of the end of the combustion cycle.
- On boilers, inspect for evidence of water or combustion product leaks.
- On boilers, determine that the water pumps and automatic controls are in operating condition.
- If accessible, inspect the central air conditioner coils.
- Check the fan and belt condition.
- Inspect for exposed wiring.

  5.3003.4 (a,b,c,d,e,f.g.h) Heating & Cooling – Forced Air – System Assessment & Maintenance – Evaluating Electrical Service (SF)

  5.3003.16 (a,b,c,d,e,f,g,h,i) Heating and Cooling – Forced Air – System Assessment and Maintenance - Evaluating Electrical Service (MH)
- Inspect the refrigerant lines

  5.3003.5 (a,b,c,d,e) Heating & Cooling – Forced Air – System Assessment & Maintenance – Refrigerant Line Inspection (SF) (MH)

The following additional standards must be followed when *Heating System*s are designed, inspected, repaired, tune and cleaned and/or replaced through the Nebraska Weatherization Assistance Program:

5.3003.1 (a) Heating & Cooling – Forced Air – System Assessment & Maintenance – Data Plate Verification (SF) (MH)

5.3003.3 (a,b,c,d,e,f,g,h) Heating & Cooling – Forced Air – System Assessment & Maintenance – Evaluating Air Flow (SF) (MH)

5.3003.7 (a,b,c,d,e,f,g,h,I) Heating & Cooling – Forced Air – System Assessment & Maintenance – Occupant Education(SF) (MH)

5.3003.10 a,b,c,d,e,f,g,h) Heating & Cooling – Forced Air - Systems Assessment & Maintenance – Condensate Drainage of Heating and Air Conditioning Equipment (SF)

5.3003.14 (a,b,c,d,e,f) Heating & Cooling – Forced Air - Systems Assessment & Maintenance – Combustion Analysis of Gas-Fired Appliances (LP and Natural Gas) (SF) (MH)

***Heating System* Clean & Tune and Maintenance Requirements**

The following standards must be followed when *Heating System*s are repaired and/or tuned and cleaned through the Nebraska Weatherization Assistance Program:

- A tune and clean may be performed on *Eligible Heating Plants*, excluding baseboard and/or cove heat.
- In owner occupied homes, if the material and labor to correct deficiencies in *Eligible Heating Plants* exceeds $500, the unit must be replaced. However, unique situations may be dealt with on a case by case basis.
- In renter occupied homes, if the material and labor to correct deficiencies in *Eligible Heating Plants* exceeds $400, the owner must repair or replace the *Heating Plant*. However, if replacement is made in accordance with the requirements of these installation standards, the Weatherization Assistance Program may contribute a maximum of $500, for the replacement of the *Heating Plant* and flue liner, if one is necessary.
- Weatherization of the *building envelope* must not proceed until the unit has been repaired or

replaced.

- A maximum of $500 may be spent to repair unsafe solid fuel combustion *Heating System*s.
- If a dwelling is heated by *Unvented Combustion Space Heaters* and an inoperable eligible *Heating System* is present, the eligible *Heating System* must be repaired or replaced to eliminate the need for unvented space heaters.
- If the need for *Unvented Combustion Space Heaters* cannot be eliminated, the sub-grantee must instruct the client regarding the dangers of carbon monoxide and excessive moisture levels, particularly if any unvented space heaters are left in the dwelling as a secondary *Heat Source*, or emergency back-up.
- Existing furnaces that will accept dedicated combustion air should be retrofitted.

Gas Fired Furnace Clean and Tune Requirements:

- must be completed by a *Qualified Heating Technician* and must include the following:
  - Lubricating all moving parts
  - Calibrating and adjusting the thermostat
  - Cleaning or replacing the furnace filter
  - Adjusting the *conditioned* air flow, high limit control, fan control and temperature rise
  - Cleaning and adjusting the burners
  - Removing and cleaning the blower
  - Cleaning and vacuuming the return air and furnace cabinet, filter rack, exhaust port and draft hood
  - Cleaning the heat exchanger
  - Adjusting the belt tension or replace the belt
  - Sealing the thermostat wire penetration
  - Testing the furnace for CO and adjusting or repairing the furnace as needed
  - If accessible, inspecting and cleaning the central air conditioner coils.

Electric Furnace Clean and Tune Requirements:

- must be completed by a *Qualified Heating Technician* and must include the following:
  - Lubricating all moving parts
  - Calibrating and adjusting the thermostat
  - Cleaning or replacing the furnace filter
  - Adjusting the *conditioned* air flow, high limit control, fan control and temperature rise
  - Removing and cleaning the blower
  - Cleaning and vacuuming the return air and furnace cabinet, filter rack and electric elements
  - Adjusting the belt tension or replacing the belt
  - Sealing the thermostat wire penetration
  - Testing the heating elements and sequencers
  - Inspecting the interior and exterior wiring inside the cabinet on electric units
  - If accessible, inspecting and cleaning the central air conditioner coils.

Cooling System Maintenance

The NeWAP provides limited funding to complete repair and/or maintenance on existing central cooling systems including:

- A maximum $500 may be spent to repair heat pumps and central air conditioning systems.
- In renter occupied homes, if the cost to repair the central air conditioner or heat pump

exceeds $500, the owner may repair or replace the unit. However, if the central air conditioner or heat pump is replaced in accordance with the requirements of this Field Guide and Installation Standards, the Nebraska Weatherization Assistance Program (NeWAP) may contribute a maximum of $500 to the replacement cost.

- Drip pans in poor condition may be replaced.
- Air conditioner evaporator coils in existing operable units must be replaced if they do not fit in new *Heating Plants* installed as part of NeWAP services.
- Prior to completing repair and/or maintenance on existing central cooling systems the existing unit must be inspected and evaluated with appropriate documentation included in the client file.

5.3003.1 (a) Heating & Cooling – Forced Air – System Assessment & Maintenance – Data Plate Verification (SF) (MH)

5.3003.3 (a,b,c,d,e,f,g,h) Heating & Cooling – Forced Air – System Assessment & Maintenance – Evaluating Air Flow (SF) (MH)

5.3003.7 (a,b,c,d,e,f,g,h,i)Heating & Cooling – Forced Air – System Assessment & Maintenance – Occupant Education (MH)

5.3003.8 (a,b,c,d,e,f,g,h,i)Heating & Cooling – Forced Air – System Assessment & Maintenance – Occupant Education (SF)

5.3003.10 (a,b,c,d,e,f,g,h) Heating & Cooling – Forced Air - Systems Assessment & Maintenance – Condensate Drainage of Heating and Air Conditioning Equipment (SF)

5.31 Hydronic Heating (Hot Water and Steam)

The following standards must be followed when hydronic *Heating Systems* are designed, repaired and/or tuned and cleaned through the Nebraska Weatherization Assistance Program:

5.3101 Design

5.3101.1 (a,b) – Heating and Cooling – Hydronic Heating (Hot Water and Steam) – Design - Heat Load Calculation—Whole House (SF)

5.3101.2 (a) - Heating and Cooling – Hydronic Heating (Hot Water and Steam) – Design - Space Load Calculation—Heat Emitter Sizing (SF)

5.3104 Equipment Maintenance, Testing, and Repair

5.3104.1 (a,b,c,d,e,f) Heating and Cooling – Hydronic Heating (Hot Water and Steam) – Equipment Maintenance, Testing, and Repair - Controls—Thermostat Replacement (SF)

5.3104.2 (a,b,c,d,e,f,g,h,i) Heating and Cooling – Hydronic Heating (Hot Water and Steam) – Equipment Maintenance, Testing, and Repair - Maintenance: Gas Boiler Service Inspection (SF)

5.3104.3 (a,b,c,d,e,f,g,h,I,j,k,l,m) Heating and Cooling – Hydronic Heating (Hot Water and Steam) – Equipment Maintenance, Testing, and Repair - Maintenance: Checklist (SF)

6 VENTILATION

6.60 Exhaust

6.6002 Components

Achieving effective exhaust in all buildings requires appropriate the design, configuration, connection, insulation (depending on location), equipment and terminations. NeWAP sub-grantees *must* utilize the following standards for implementing exhaust ventilation.

6.6002.1 (a,b,c.d) Ventilation – Exhaust – Components - Ducts (SF)

6.6002.2 (a,b,c,d,e,f,g) Ventilation – Exhaust – Components - Terminations(SF)

6.6002.3 (a,b) Ventilation – Exhaust – Components - Exhaust-Only Ventilation (SF) (MH)

6.6002.4 (a,b,c,d,e,f) Ventilation – Exhaust – Components - Ducts (Exhaust Fans) (MH)

6.6003 Fans

NeWAP sub-grantees *must* adhere to the following standards for the purchase and installation of exhaust fans.

6.6003.1 (a,b,c,d,e,f,g,h,i,j) Ventilation – Exhaust – Fans - Surface-Mounted Ducted (SF) (MH)
6.6003.2 (a,b,c,d,e,f,g,h,i) Ventilation – Exhaust – Fans - Inline (SF) (MH)
6.6003.3 (a,b,c,d,e,f,g,h,i,j,k) Ventilation – Exhaust – Fans - Through the Wall (SF)
6.6003.6 (a,b,c,d,e,f) Ventilation – Exhaust – Fans - Fan Placement (Whole House/Common Space Exhaust Only) (MH)

6.6005 Appliance Exhaust Vents

Dryer Vents

Venting dryers indoors, into an attic or other areas of a home can lead to mold to growth, respiratory or more serious health conditions. NeWAP Sub-Grantees *must* vent existing unvented or improperly vented clothes dryers to the exterior of the home using the following installation standards:

- Dryer vent pipe should not be installed with sheet metal screws, rivets or other intrusive fasteners that will collect lint.
- Acceptable fasteners include clamps, straps and duct mastic with mesh tape.
- Dryer vent pipe must be metal and the termination cap must be dampered and attached with rust proof fasteners.
- Dryer vent ductwork must be smooth surfaced and whenever possible, not exceed 14 feet in length.
- No more than two 90 degree elbows may be used in the vent system.
- Relocation of dryers may need to be considered to meet this vent pipe length limitation.
- Flexible metal vent pipe may be used if it does not exceed 8 feet in length. The dryer vent pipe must not be installed with sheet metal screws, rivets or other intrusive fasteners that will collect lint.

6.6003.3 (a,b,c,d,e,f,g,h,i,j,k) Ventilation – Exhaust – Fans - Through the Wall (SF)
6.6005.1 (a,b,c,d,e) Ventilation – Exhaust – Appliance Exhaust Vents - Clothes Dryer (SF) (MH)

Kitchen Range Vents

Venting kitchen range vent indoors, into an attic or other areas of a home can lead to mold to growth, respiratory or more serious health conditions. NeWAP Sub-Grantees *must* vent existing unvented or improperly vented kitchen range vents to the exterior of the home.

6.6003.3 (a,b,c,d,e,f,g,h,i,j,k) Ventilation – Exhaust – Fans - Through the Wall (SF)
6.6005.2 (a,b,c,d,e,f,g) Ventilation – Exhaust – Appliance Exhaust Vents - Kitchen Range (SF) (MH)

6.61 Supply

6.6102 Components

Successfully supplying air into a building with appropriate the design, configuration, connection, insulation (depending on location), equipment and terminations help to improve indoor air quality and prevent condensation. NeWAP sub-grantees *must* utilize the following standards for providing supply air in a home.

6.6102.1 (a,b,c,d,e,f) Ventilation – Supply – Components - Outside Air Ventilation Supply Ducts (SF)
6.6102.2 (a,b,c,d,e,f,g,h) Ventilation – Supply – Components - Intakes (SF)
6.6102.3 (a,b,c,d,e,f) Intake for Ventilation Air to Forced Air System Used for Heating or cooling (SF)
6.6102.4 (a,b,c,d,e,f,g,h) Ventilation – Supply – Components - Intake for Ventilation Air to Forced Air System Used for Heating or Cooling (MH)

6.6188 Special Considerations

NeWAP sub-grantees *must* utilize the following standards regarding supply air in conjunction with garages.

6.6188.1 (a,b,c,d,e,f) Ventilation – Supply – Special Considerations - Removing Supply Vents from Garages (SF)

6.6188.2 (a,b,c,d,e,f,g) Ventilation – Supply – Special Considerations - Removing Supply Vents from Garages (MH)

6.62 Whole Building Ventilation

Mechanical Ventilation to Ensure Acceptable Indoor Air Quality

NeWAP sub-grantees *must* implement the latest version of ASHRAE 62.2 to ensure acceptable indoor air quality in weatherized homes and all project files *must* include appropriate ventilation sizing documentation.

- Complete pre- and post-weatherization ASHRAE 62.2 evaluations to ensure that the home meets the *Standard for Acceptable Indoor Air Quality* and include both evaluations in the client file.
- Install *Continuous Ventilation* as required utilize the following standards air flow requirements, components, sound limitations and client education.

6.6201 Air Flow Requirements

6.6201.1 (a,b,c) Ventilation – Whole Building Ventilation – Air Flow Requirements - Installed System Air Flow (SF)

6.6201.2 (a) Ventilation – Whole Building Ventilation – Air Flow Requirements - Primary Ventilation Air Flow between Rooms (SF)

6.6202 Components

6.6103.1 (a,b,c,d,e,f,g,h) Ventilation – Whole Building Ventilation – Air Flow Requirements Inline or Multi-Port (SF)

6.6202.1 (a,b,c,d,e) Ventilation – Whole Building Ventilation – Air Flow Requirements - Controls (SF)

6.6205 Exhaust-Only Strategies for Manufactured Housing System

6.6205.1 (a,b,c,d,e,f,g) Ventilation – Whole Building Ventilation – Exhaust-Only System - Manufactured Housing Exhaust-Only Strategies (MH)

6.6288 Special Considerations

6.6288.1 (a,b) Ventilation – Whole Building Ventilation – Special Considerations - Air Flow Requirements Sound-Rating Limits (SF)

6.6288.2 (a,b) Ventilation – Whole Building Ventilation – Special Considerations - Sound Ratings—New Fan Installation (MH)

6.99 Additional Resources

6.9901 Codes and Standards Resources

6.9901.1 (a) Ventilation – Additional Resources – Special Considerations Supplemental Ventilation Information—ASHRAE 62.2 (SF) (MH)

7 Baseload

Base load is the energy consumed in the home that is not related to heating and/or cooling the home. Base loads include the energy used for lighting, appliances, and water heating, but also includes plug loads for televisions, radios, computers, etc. and they are generally consistent from month to month.

7.80 Plug Load

7.8003 Lighting

Lighting upgrades are one of the most cost-effective options available for reducing a buildings base load. Replacing traditional lights and upgrading switching can save 75% or more on your client's

lighting energy costs. Lighting Measures that are indicated as cost-effective in the Energy Audit ***must*** be implemented.

- Lumen output should be matched as closely as possible to the lighting that was removed.
  7.8003.1 (a,b) Baseload – Plug Load – Lighting – Lighting Upgrade (SF) (MH)
- Electro-luminescent or LED nightlights may be installed to replace existing incandescent night lights.

7.81 Water Heating

Water Heating is generally the second highest source of energy usage in a home. The costs associated with water heater repair and/or replacements are eligible for reimbursement through the NeWAP. Water Heating Measures that are indicated as cost-effective in the Energy Audit ***must*** be implemented.

7.8101 Water Use Reduction

Water Saving Showerheads, Faucet Aerators, and Leaky Faucets; don't just consider the water they waste; they also waste the energy that was used to heat the water being lost.

Inspection Requirement

- Inspect faucets for hot-water leaks.
- Showerhead Replacements that are indicated as cost-effective in the Energy Audit ***must*** be implemented.
  7.8101.1 (a,b,c,d) Baseload – Water Heating – Water Use Reduction – Shower Head and Faucet Aerator (SF) (MH)

7.8102 Water Heater Installation and Replacement Requirements

- *Unsafe water heaters* that cannot be repaired ***must*** be replaced. Weatherization of the building must not proceed until the water heater has been repaired or replaced.
- ***With Nebraska Energy Office approval***, replacement water heaters may utilize a new fuel source.
- In owner occupied homes, the replacement of water heaters for energy efficiency reasons may not be charged to the Health & Safety line item.
- New gas water heaters ***must*** have a minimum efficiency of .59 and new electric water heaters ***must*** have a minimum efficiency of .91.
- All repairs and replacements ***must*** be performed by a qualified heating or plumbing technician or utility company.
- A service label ***must*** be placed on or near the water heater containing the name, business address and phone number of the company or agency performing the work, any repairs that were completed and the date the work was performed.
  7.8102.1 (a,b) Baseload – Water Heating – Installation & Replacement – Water Heater Selection (SF) (MH)
  7.8102.2 (a,b,c,f,g,h,I,j,k,m,n) Baseload – Water Heating – Installation & Replacement –Storage-Type Appliances (SF) (MH)
  7.8102.3 (a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q) Baseload – Water Heating – Installation & Replacement – On-Demand Appliance (SF) (MH)
  7.8103.1 (a,b,c,d,e,f,g,h) Baseload – Water Heating – Maintenance/Inspection – Storage-Type Appliance (SF) (MH)
  7.8103.2 (a,b,c,d,e,f,g,h,I,j,k,l,m) Baseload – Water Heating – Maintenance/Inspection – On-Demand Appliance (SF) (MH)

Manufactured Home specific work standards

- Replacement gas water heaters in mobile homes must be specifically designed as mobile home water heaters.

7.8103 Water Heater Maintenance/Inspection/Repair Requirements

- Existing unvented gas water heaters ***must*** be vented to the exterior.
- Missing or damaged drip legs ***must*** be replaced as per local, state and national codes and be plumbed within 6 inches of the floor.
- A ***maximum*** of $250 in material and labor may be spent to correct deficiencies in water heaters. If the material and labor exceeds $250, the unit ***must*** be replaced in owner occupied homes.
- In renter occupied homes, the owner ***must*** repair or replace the water heater. If the replacement is made in accordance to these installation standards the Weatherization Assistance Program may contribute a maximum of $150. Weatherization of the building ***must not*** proceed until the water heater has been repaired or replaced.
- All water heaters ***must*** have working pressure relief valves with drip legs without threaded bottoms.

7.8102.2 (a,b,c,f,g,h,i,j,k,m,n) Baseload – Water Heating – Installation & Replacement – Storage-Type-Appliance (SF) (MH)

7.8103.1 (a,b,c,d,e,f,g,h) Baseload – Water Heating – Maintenance/Inspection – Storage-Type Appliance (SF) (MH)

7.8103.2 (a,b,c,d,e,f,g,h,I,j,k,l,m) Baseload – Water Heating – Maintenance/Inspection – On-Demand Appliance (SF) (MH)

***Safety Inspection* Standards**

The *Safety Inspection* ***must*** include all of the following that apply to the water *Heating System* being inspected:

- Conduct a fuel leakage test of the appliance piping and control system downstream of the shutoff valve in the supply line to the appliance.

2.0201.1 (b) Health & Safety – Safe Work Practices – Combustion Safety Testing-General – *Combustion Appliance Zone* – Fuel Leak Detection (SF)

- Visually inspect the venting system for proper size and horizontal pitch and determine that there is not blockage, vent size reduction or restriction, leakage, corrosion or other deficiencies that could cause an unsafe condition.

2.0201.1 (c) Health & Safety – Safe Work Practices – Combustion Safety Testing-General – *Combustion Appliance Zone* - Venting (SF)

- Inspect burners and crossovers for blockage and corrosion.
- Determine that the pilot is burning properly and that main burner ignition is satisfactory.
- Test the pilot safety device to determine that it is operating properly.
- Visually determine that main burner gas is burning properly.
- Test for spillage at the draft hood relief opening.
- Determine that water heater has a pilot access door, pressure relief valve with drip leg and draft hood.
- Inspect for evidence of water or combustion product leaks.
- Inspect for exposed wiring.

2.0105.1 (a) Health & Safety – Safe Work Practices – Baseload – Baseload Worker Safety (SF)

2.0201.1 (a) Health & Safety – Safe Work Practices – Combustion Safety Testing-General –

7.8104 Water Heating *Distribution System* Requirements

Water Heater Tank and Pipe Insulation and *Distribution System* improvements help to reduce heat loss. These types of improvements can also help to reduce the amount of time that people wait for hot water after they turn on the faucet or shower.

Tank and Pipe Insulation Requirements

- Water heater tank insulation ***must*** be a minimum R-11 blanket secured with tape and bound with a minimum of 2 wire, cord, plastic, or nylon bands on the tank.
- Insulation ***must not*** be installed on water heaters if doing so voids the warranty of the unit.
- Insulation ***must not*** cover the pressure relief valve, end of the drip leg, draft hood, burner air inlet, pilot light access door, thermostat control, drain valve or the top of the water heater on natural gas or propane water heaters.
- Electric water heaters ***must*** have the top insulated and the thermostat control access panels accessible or marked and labeled.
- Insulation ***must not*** cover the pressure relief valve, the drip leg, high limit switch, and plumbing pipes or drain valve on electric water heaters.
- Water lines ***must*** be insulated a minimum of 18 feet of hot and 6 feet of cold in all directions from the water heater, using properly sized preformed pipe wrap or insulation specifically designed as pipe wrap.
- *Accessible Hydronic pipes* ***must*** be insulated with 1 inch material having a minimum R-4 pipe insulation specifically manufactured as hydronic pipe insulation. Joints and elbows ***must*** be insulated.
- Each section of preformed pipe wrap ***must*** be fastened with a minimum of 3 wire, cord, plastic or nylon bands.
- Joints and elbows ***must*** be insulated.
- Duct tape ***must not*** be used as a means of fastening pipe wrap.
- Pipe wrap ***must not*** be installed within 3 inches or farther than 4 inches of a flue and/or draft hood.
- Water lines that have asbestos pipe wrap ***must not*** be insulated or sealed in the area containing the asbestos.
- In *Manufactured Homes*: All accessible water lines in the water heater compartment ***must*** be insulated using properly sized preformed pipe wrap or insulation specifically designed as pipe wrap.

7.8102.2 (i) Baseload – Water Heating – Installation & Replacement – Storage-Type-Appliance (SF) (MH)

8 Definitions

A

Accessible Attic: An attic with a minimum 24 inch clearance measured from the bottom of the top cord or ridge board to the top of the ceiling joists.

Accessible Ductwork/Hydronic pipes: Ductwork or *Hydronic pipes* with a minimum twenty four (24) inch clearance on a minimum of two (2) sides of the ductwork or *Hydronic pipes*.

Accessible Foundation: A foundation with a minimum 24 inch clearance measured from the bottom of the floor joist to the ground.

Air Infiltration Barrier: A covering that will allow moisture out and not allow air into a space or wall cavity.

Accessible Kneewalls: A *Kneewall* with a minimum 36 inch clearance measured from the top of the floor joist to the bottom of the rafters and a minimum 36 inch clearance measured from the *Kneewall* to the exterior wall.

Atmospherically Vented Combustion Appliance:
The most common type of gas appliances are atmospherically vented. They use a natural way to move the flue gases from the unit out with a vertical metal pipe, sometimes connected to the chimney, where the hot flue gases rise through the draft hood and flue pipe, and out into the atmosphere. The advantage of these types of appliances is the lower cost of the units and installation; however they also generally have a lower efficiency rate than the other systems.

B

Backdraft Damper: A damper that allows air to flow in only one direction.

Basement: The bottom full height story of a building below the first floor. A *Basement* may be partially or completely below grade.

Building Envelope: The elements of a building between the interior and exterior environments that includes a combination of both the air and thermal barrier.

C

Certified Weatherization Staff: A subgrantee staff person who has successfully completed appropriate training to perform a task in the weatherization program.

cfm^{50}: Cubic feet per minute of airflow at a 50 Pascal pressure difference between the interior and exterior of a structure.

Combustion Appliance Zone (CAZ): An area containing one or more *atmospherically vented combustion appliances.*

Conditioned Space: A space that contains a source intended specifically to heat or cool that space.

Continuous Ventilation: The process of mechanically removing stale air from a building or room by providing fresh air on a slow, continuous basis.

Cost Effective Blower Door Guided Air sealing: The process of using a blower door to pressurize a home or building to determine the energy savings ratio between the calculated air sealing cost and *Infiltration* reduction.

Crawl Space: A space below the first floor of a conditioned or *Unconditioned* building that is less than full story height.

Crossover-Duct: Enclosed air pathway to move conditioned air from one side of a double-wide *manufactured home* to the other side or from a *manufactured home* to a frame edition.

D

Dense pack: The process of installing loose-fill insulation at a density that allows it to reduce air flow and perform to a stated R-value.

Distribution System: The enclosed pathway for conditioned air to travel to and from the heating/cooling plant. It ***must*** include but is not limited to the metal or fiber duct, panned floor cavity, designated wall cavity and the point where funnels and boots meet the wall or floor.

Direct Vent Appliances:
Direct vent units are generally newer units designed to supply outdoor air directly to the sealed combustion chamber and then exhaust the flue gases to the outside of the home. Direct vent units include most condensing furnaces, mobile home furnaces, mobile home water heaters and some space heaters.

Disabled/Inoperable Heating Plants: *Heating Plants* that have had the fuel source disconnected and/or capped and the flue disconnected.

E

Egress window: A window that people can escape through in an emergency. The location, size and clearance requirements are dictated by the local building jurisdiction.

Eligible Heating Plant: A furnace or boiler that utilizes natural gas, propane, fuel oil or electricity as the fuel/energy source. *Eligible Heating Plants* include forced air, gravity, wall, floor, electric baseboard, mobile home furnaces, heat pumps and boilers. Gravity furnaces that have been retrofitted with a blower or that have been converted from one fuel source or another are also eligible.

Exposed Floors: A floor that is in direct contact with the outside air (i.e. cantilevers, floors of bay or bow windows, garage ceilings, etc.).

F

Finished Attic: An attic space in a home that has been converted into an additional living space.

Fenestration: Openings in the walls of a building structure (i.e. windows, doors, etc.).

H

Hard Wired Alarms: Alarms (Smoke, Propane, CO, Moisture) that are wired directly into the building's electrical system.

Heating Plant: A boiler or furnace, not including the flue, fuel piping, thermostat, *Distribution System*, etc.

Heating System: A *Heating Plant* and the associated connections necessary for operation including, but not limited to, the flue, fuel piping, thermostat, *Distribution System*, etc.

Heat Source: Type-B vent, masonry chimneys that vent natural gas or propane and exhaust fans.

High Heat Source: Heat produced through the combustion process by solid fuel and/or fuel oil combustion appliances. Recessed lighting is also considered a *High Heat Source*.

Hydronic pipes: Piping system used to distribute water or steam to and from water boilers or steam *boilers*.

I

Inaccessible Underbellies: A mobile home underbelly with less than 24 inches clearance, measured from the *Weatherboard* to the ground at the area to be weatherized.

Incidental Repair Cost: Repair costs related to ensuring the effective performance or preservation of a new or existing weatherization measure.

Infiltration: The uncontrolled passage of outside air into a building through leaks in the *building envelope*.

Insulated Glass: The combination of two or more panes of glass sealed with air or inert gas between the panes.

K

Kneewall: A vertical wall between an attic and a *Conditioned Space*.

L

Ledged Basement: A *Basement* constructed with a concrete or dirt ledge less than 6 feet front to back, around the perimeter of the foundation. The ledge may be only around a portion of the foundation wall. Ledges more than 6 feet front to back are considered a *Crawl Space*.

Living area: An area within the conditioned envelope that is used on a regular basis for sleeping, eating, bathing etc.

M

Manufactured Homes: Commonly known as mobile homes, is a type of prefabricated home that is assembled in a factory and transported to a site.

MERV (Minimum Efficacy Reporting Value) Filter: A filter that is tested, and rated, for its ability to filter and remove different size partials (pollutants) from the air. Basically, the higher the *MERV* rating, the higher the filtering performance.

Multi-family Buildings: The U.S. Department of Energy defines multifamily buildings based primarily on building size and heating characteristics:

- Small Multifamily: 5-25 units individually heated/cooled, ≤ 3 stories in height
- Large Multifamily: 25+ units, ≥ 4 stories in height
- 5-25 units centrally heated/cooled, any height

O

Orphaned Equipment: A smaller combustion appliance (e.g., water heater) that remains in place after a larger appliance, that was commonly vented with the remaining unit, is removed or replaced and no longer utilizes the common vent. The larger exhaust flue or chimney that the unit continues to utilize is generally larger than necessary for the remaining smaller appliance.

P

Perm rating: The measurement of a material's ability to allow the transfer of water vapor through the material.

Pressure Treated: Lumber that has been commercially treated under pressure with a wood preservative to prevent damage from moisture, insects, fungi and other forms of biological decay.

Programmable Thermostat/Setback Thermostat/Setback Thermostat: A thermostat designed to adjust temperature settings according to a series of programmed settings that take effect at different set times of the day.

Q

Qualified Heating Technician: An individual or company that is specifically involved in the installation and/or servicing of residential heating/ cooling systems.

Quality Control Inspection: An inspection that verifies that the work completed on the home complies with quality work standards and program regulations as defined by the Nebraska Energy Office and the U.S. Department of Energy.

S

Safety Glass: A type of glass that is designed to resist breaking, and to break in a way that minimizes the risk of injuries in the event the glass cannot withstand the forces on it.

Safety Inspection: An inspection performed by a *Qualified Heating Technician*, a natural gas utility, a propane supplier or *certified weatherization staff*.

SIR (*Savings to Investment Ratio*): A ratio of economic performance as calculated by NEAT MHEA and TREAT audits. An *SIR* of 1.0 indicates the weatherization measure will pay for itself one time during its life.

Spray-Applied Insulation: Insulation manufactured specifically to be spray-applied.

Stack Effect: The tendency for warm air to move upwards in a building or chimney, creating pressure differentials.

T

Tempered Glass: Toughened type of *Safety Glass* processed by control thermal or chemical treatments to increase its strength compared with normal glass.

Tube-fill method: An insulation technique developed to install high density blown insulation in enclosed cavities.

Type-S-Fuse: A non-removable adapter that is screwed into the fuse socket permitting only one size fuse to be installed.

U

Unconditioned: An area having no source of heating or cooling.

Under-cut: To cut the bottom of an interior door to allow return air to flow from that area to the furnace compartment or common return.

Unsafe water heater: A unit that 1) has been red tagged by a utility company/supplier or a building code jurisdiction, 2) shows visual signs of deterioration such as scorch marks indicating past backdrafting occurrences 3) shows signs of compromised water tank integrity as evidenced by signs of leakage 4) when tested exceeds 100-ppm as measured in the flue gases or 0-ppm in the ambient air and the CO levels cannot be reduced.

Unvented Combustion Space Heater: An unvented gas heating unit generally intended to supply heat to a small area.

V

Vapor barrier: A material that retards the passage of water vapor and contains a *Perm rating* of less than 1.

Vapor retarder: A material that slows the passage of water vapor and contains a *Perm rating* above 1.

W

Weatherboard: A covering consisting of a minimum # 30 felt paper, exterior grade plywood, fiberboard, an *air Infiltration barrier* or a material specifically manufactured as mobile home *Weatherboard* installed on the underside of a mobile home to support and protect the floor insulation.